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ENGINES OF STEAMSHIP PARISIAN.

We illustrate an example of one of the latest types of English marine engines, as built by R. Napier & Sons, Glasgow, such as are used on their ocean going ships. The vessel which these engines propel is 450 feet long and 46 feet wide, and has 10,000 tons displacement.

As will be seen, the engines are vertical compounds, of the "tandem" type; that is, with the cylinders in line with the keel.

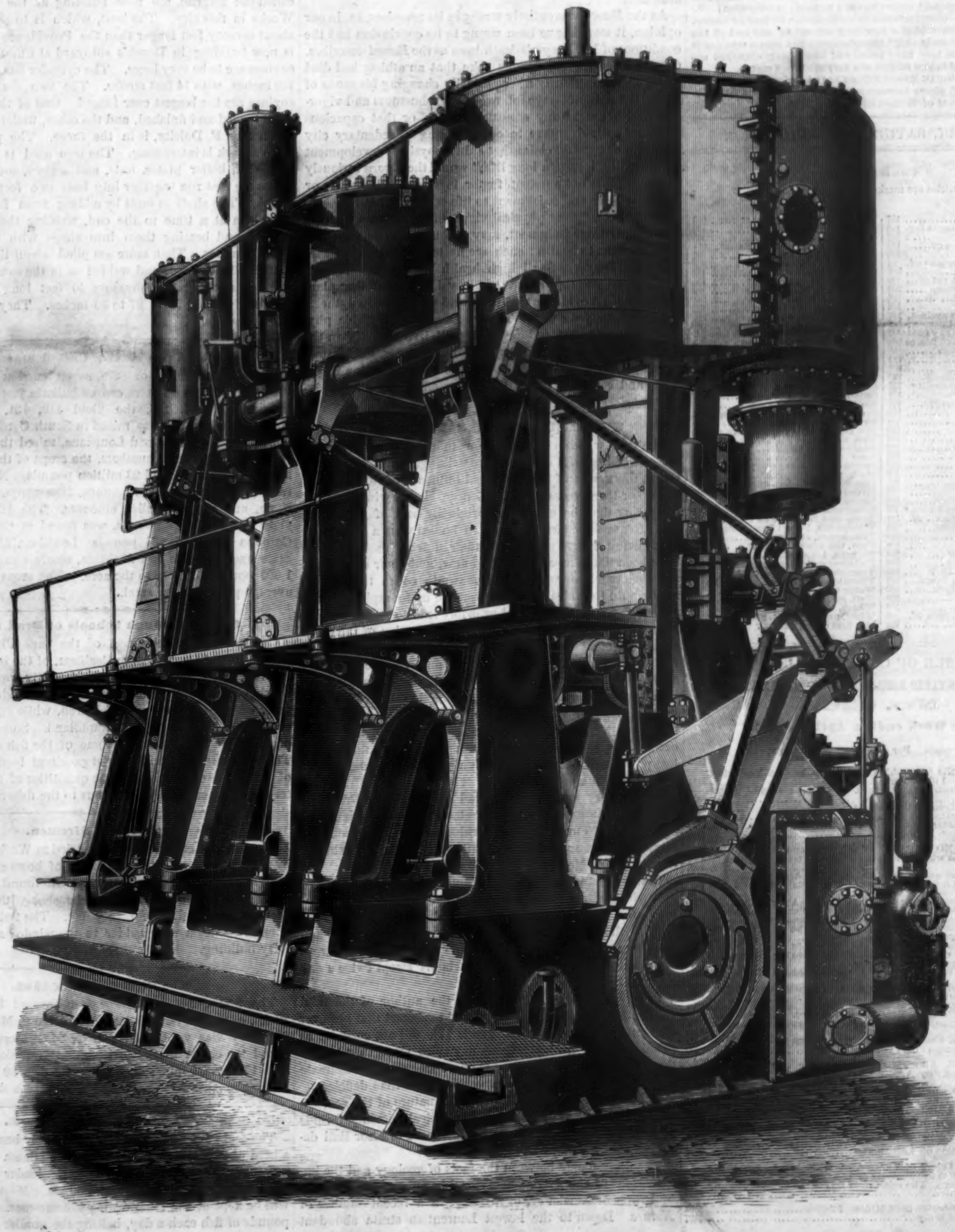
There are one high-pressure and two low-pressure cylinders, which are 60 inches and 85 inches respectively, with 5 feet stroke of piston. The crank shaft is of steel, 20 inches diameter, while the crank pins are 21 inches diameter, by the same length. Steam of 75 pounds pressure is used.

The general arrangement of the engines is well shown in the engraving, so that we need add but little by way of explanation. The valves are of the piston variety, and are worked by a link motion, which is peculiar in some details, especially the rock shaft and levers which connect the link motion with the valve stems.

These engines are handled for reversing or going ahead by a single steam cylinder which is located behind the central main cylinder, connecting directly by a rod with the reverse shaft, the arm of which is shown in the extreme left of the engraving, and the air pumps are worked directly from the cross head of the main engines instead of a separate engine.

With the propeller blades four feet out of water (owing to light draught of the ship) these engines were run at 85 revolutions per minute, at which speed they indicated 6,020 horse power.

This is very high piston speed for such large pistons—850 feet per minute—and it shows to what perfection modern workmanship has attained when it is possible for even a short time.—*Engineer.*



COMPOUND "TANDEM" ENGINES OF STEAMSHIP PARISIAN.

Scientific American.

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NEW YORK, SATURDAY, APRIL 1, 1882.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT,

No. 326,

For the Week ending April 1, 1882.

Price 10 cents. For sale by all newsdealers.

A MORAL MISAPPLIED.

Noticing the recent death of John J. Dwyer, prize fighter and lately heavy weight champion of America, within two years of his leaving the prize ring and accepting a city clerkship, the *Medical Record* draws from his untimely fate the following curious "lesson:"

"The cultivation of a powerful muscular development does not of itself insure health and long life. It may even entail a certain danger. The man who makes an athlete of himself must continue one, or else drop his exercise with slowness and caution. Our ex-pugilist accepted a sedentary occupation after he had cultivated his lungs to perhaps double the capacity needed in such an employment. A disused organ degenerates and becomes liable to disease. The robust chest of the country youth may be a source of danger to him if he adopts life in a city office. A fine physical development does not necessarily insure a long life. Robustness is only a relative term. In the physical education of youth, therefore, we should aim to make every organ healthy—not hypertrophied. The law that the organism must be adapted to its environment was well illustrated by the prize-fighter, who was attacked with consumption eighteen months after he had left the ring for a city office."

If the *Record* had been better informed with regard to the cause of Mr. Dwyer's death, its comments thereon would probably have been very different. As we understand it, his trouble was not in his lungs, nor could any amount of sedentary occupation have engendered it. As little could it be charged to his training or his habits as a prize fighter and athlete.

As the *Record* was entirely wrong in its premises, so, in our opinion, it would have been wrong in its conclusion had the conditions of Mr. Dwyer's death been as the *Record* describes. Granting for the argument's sake that an athlete had died of consumption shortly after radically changing his mode of living, it would not have followed that robustness and vigorous health are in any case undesirable, or that capacious lungs are a disadvantage to one adopting a sedentary city life. No one would claim that a fine physical development "necessarily insures a long life;" would the *Record* seriously assert that it is not a potent factor in securing long life, or in giving force and enjoyment to life while life lasts?

It is true that great physical vigor, in the absence of high principle and fine judgment, may encourage excesses which are hazardous to health; such seems to have been the case with Mr. Dwyer. Shall high health be therefore discouraged? The ascetics of the mediæval ages tried that plan, but there is no evidence that the world was benefited thereby, or themselves either. The wise man with a feeble physical organism may, and probably will, live longer than the fool with a physique like Dwyer's; but with Dwyer's frame, the wise man would probably live as long as with a feeble body, and certainly would live more efficiently and enjoyably.

SPECIALISTS AND GENERAL PROBLEMS.

The risks which a specialist runs in attacking problems of a broad and general character are strikingly illustrated in the recent discussion of the geological influence of tides.

Two or three years ago Mr. George H. Darwin advanced the theory that the moon was originally part of the earth; that after their separation the two bodies were a long time in drawing apart; meanwhile their diurnal motions must have been much more rapid than now, and their mutual attractions much more forcefully shown in ocean tides. Not only would the tides be higher, but the more rapid alternation of day and night would probably lead to more sudden and violent storms; and the more rapid rotation of the earth would augment the violence of the trade winds, which, in their turn, would increase the force and volume of ocean currents. The result of all this, he held, would necessarily be a great acceleration of geological action. Rivers would flow with fuller streams bearing a heavier freightage of earthy matter to the sea; and the erosive force of the higher ocean tides and the swifter ocean currents would be not less powerfully shown in modifying the continental masses and in rearranging the detritus.

This theory was taken up and elaborated by Professor Ball, the Astronomer Royal of Ireland, in the lecture entitled "A Glimpse Through the Corridors of Time," which has attracted so much attention. (See SCIENTIFIC AMERICAN SUPPLEMENT, No. 322.)

In this lecture Professor Ball contemplates as a factor of geological history ocean tides of appalling height and violence, the result of the diminished distance of the moon. Within the times covered by the geological record, and helping to account for some of its conditions, he saw all ocean shores and the adjacent lowlands swept twice a day by tides six hundred feet high.

In this Prof. Ball so surpasses the author of the tidal theory that Mr. Darwin is compelled to protest that he never contemplated anything of the sort. He did not consider as possible within geologic times any tides more than two or three times as high as those we now see; and this estimate he is now inclined to think excessive rather than deficient.

The form of the earth, as well as the nature of the geological record, in its vital as well as its physical elements, forbids the possible prevalence of such tides as Professor Ball describes, or anything like them.

The discrepancy between the facts of geology and the imaginations of the Astronomer Royal have been aptly shown by Professor Newberry, of this city, in a recent number of *Nature*. Down to the lowest Laurentian strata abundant evidences of life appear, much of it littoral life, while many strata are composed of organic sediments which accumulated in quiet water, deep or shallow, by the slow processes of growth and decay of animal structures. Tides greatly exceeding those which we now see would have made shore life impossible. The *Huronian* series, the next above the *Laurentian*, are all shore and shallow water deposits, telling of quiet times and the absence of excessive tides.

Particularly instructive and conclusive against the theory of high tides are the records of the physical and vital conditions presented in the later strata, from the *Lower Silurian* down through all the corridors of time into which Professor Ball peered with such distorted vision. On every side and in every age Professor Newberry finds evidence of slow and quiet accumulations of material on sandy or muddy shores, or in shallow coral seas in which animal and vegetable life would have been impossible under the action of tides such as Professor Ball describes, or indeed any tides much exceeding those of the Atlantic to-day.

Professor Ball's lecture was interesting and not without plausibility; but its chief value lies in the emphasis it gives to the fact that something more than a specialist's knowledge, however full in its department or imagination however brilliant, is needed for the solution of a problem so broad in scope and complex in detail as the physical history of a planet, or any other problem of world-wide significance.

Forging a Large Shaft.

The beam engines for the Old Colony steamboat, to be called the Pilgrim, are now building at the Morgan Iron Works in this city. The boat, which is to be of iron, and about seventy feet longer than the Providence and Bristol, is now building in Roach's shipyard at Chester, Pa. The engines are to be very large. The cylinder has a diameter of 110 inches, with 14 feet stroke. The two shafts for these engines are the largest ever forged. One of them is ready to be turned and finished, and the other, under the direction of Thomas F. Doirity, is in the forge. The process in so large a work is interesting. The iron used is made up of scraps of boiler plates, nuts, and screws, and horseshoes. These are first run together into bars two feet or more in length. The shaft is built by adding from four to six of these bars at a time to the end, welding them on in the furnace and beating them into shape with the powerful steam hammer. Then more are piled about the end of the shaft at a white heat, and welded on in the same way. The two shafts now making measure 40 feet long each, with a diameter varying from 27 to 30 inches. They weigh over 81,000 pounds.

Rice Crop of the United States.

The rice production of 1879, as returned at the census of 1880, is shown in an extra census bulletin just issued. The average was 174, 173, the yield 110, 131, 373 pounds. Nearly half the crop was raised in South Carolina, and two other States, Georgia and Louisiana, raised the bulk of the remainder. In round numbers, the crops of the three States named were 52, 25, and 23 million pounds. North Carolina raised nearly six million pounds, Mississippi, Florida, Alabama, and Texas smaller amounts. The largest average yield per acre, 725 pounds, was found in Georgia; South Carolina averaged 664 pounds; Louisiana 552. In every State except Texas and Alabama, single counties averaged 1,000 pounds or more to the acre. The areas of such high average product were small.

Sailing through Schools of Dead Fish.

Captain Henry Lawrence, of the bark Plymouth, from Antwerp, and Capt. George Coalfleet, of the bark Montreal, from Dunkirk, lately arrived in this city, reported sailing nearly all day through miles of dead fish (codfish, red snappers, and others) on the 3d of March, while off the southern end of George's Bank, Newfoundland. Some of the crew of the Plymouth picked up some of the fish and ate them. The fish were hard and proved excellent food. The cause of the death of such enormous quantities of fish is a mystery. The results may be serious to the fishermen.

Archery for Firemen.

A number of experiments were tried in Washington lately, by General Meigs, to test the utility of bows and arrows for carrying life lines for fire escapes. He found that an arrow carrying a ball of twine could be shot with considerable accuracy to a height of eighty feet. The twine was strong enough to lift a rope ladder to the windows or roof of a lofty building.

The First Comet of 1882.

The first comet of 1882 was discovered by Charles S. Wells, of the Dudley Observatory, Albany, March 17. The discovery was verified March 19, by Professor Boss, who found the comet in the constellation Hercules, right ascension 17 deg. 53 min.; declination 33 deg. 30 min. It was moving northeast at the rate of 33 minutes a day.

Sea Lions in Central Park.

The seal yard in Central Park has lately been tenanted by a herd of twenty-five sea lions from the Santa Cruz Islands, on the California coast. The male leader of the herd weighed about one thousand pounds. Most of the herd will be kept at the Park during the summer. They eat ten pounds of fish each a day, bolting the smaller fish whole.

SILK CULTURE IN THE UNITED STATES.

BY PROF. C. V. RILEY.

The Scientific American has recently contained various items respecting silk culture in the United States, and as a very marked interest in the subject has of late been manifest, it may be well to calmly consider the present prospect of the permanent establishment of the industry. This I have just done in the preface to a second edition of the "Manual on the Silk Worm," issued by the Department of Agriculture, the substance of which I would here give in advance

We can best understand the present prospects for silk culture in this country by stating the dangers to be avoided and the obstacles to be surmounted. They are:

1. The disposition to exaggerate.
2. Inexperience.
3. The higher value of labor as compared with older silk-producing countries.
4 The want of a ready market.

1.—The disposition to exaggerate is common. Enthusiasm is laudable; but the difference between the practical and successful and the visionary and unsuccessful man lies in the ability of the former to fully appreciate the obstacles to any undertaking against the tendency of the latter—whether from ignorance or purely speculative motives—to exaggerate the bright and ignore the dark side of any project. The multicaulis furor, the white willow fever, and, more recently, the Utopian claims for tea-culture and corn-stalk sugar, are examples of the evil effects of the over-zealous promulgation of narrow and one-sided views; while the failure of recent attempts to establish sericulture on the Pacific, in Kansas, at Vineland, and elsewhere, may, in each instance, be traced to over-zeal on the part of the projectors, coupled with inexperience of our country and our people. To avoid this danger we cannot too strongly enforce the facts that the elements of successful silk culture on a large scale are at the present time entirely wanting in the United States; that the profits of silk culture are always so small that extensive operations by organized bodies must necessarily fail because there are so many more lucrative ways to employ capital; that extensive silk-raising is fraught with dangers that do not beset less ambitious operations; that silk culture, in short, is to be recommended only as a light and pleasant employment for those members of the farmer's household who have no other way of earning money, and have time to spare.

2.—The want of experience is a serious obstacle to silk culture in this country; for while the mere feeding of a certain number of worms, and the preparation of the cocoons for market, are simple enough operations, requiring neither physical strength nor special mental qualities, yet skill and experience count for much, and the best results cannot be attained without them. In Europe and Asia this experience is traditional and inherited, varying in different sections both as to methods and races of worms employed. With the great variety of soil, climate, and conditions prevailing in this country, experience in the same lines will also vary, but the general principles which I have indicated in the manual afore-mentioned should govern. They may be adopted from the older countries and should be inculcated in our common schools. We have a number of special agricultural colleges to which both sexes are admitted; but I am not aware that the principles governing silk culture are ever taught to the girls attending them as helping to one means of remunerative employment which is becoming more and more desirable for that portion of our rapidly increasing population.

3.—The greater value of labor here, as compared with labor in the older silk-growing countries, has been in the past a most serious obstacle to sericulture in the United States, but conditions exist to-day that render this obstacle by no means insuperable. In the first place comparative prices, as so often quoted, are misleading. The girl who makes only twenty or thirty cents a day in France or Italy does as well, because of the relatively lower price of all other commodities there, as she who earns three or four times as much here. Again, the conditions of life are such in those countries that every woman among the agricultural classes, not absolutely necessary in the household, finds a profitable avenue for her labor in field or factory, so that the time given to silk raising must be deducted from other profitable work in which she may be employed. With us, on the contrary, there are thousands—ay, hundreds of thousands—of women who, from our very conditions of life, are unable to labor in the field or factory, and have, in short, no means outside of household duties of converting labor into capital. The time that such might give to silk culture would, therefore, be pure gain, and in this sense the cheap labor argument loses nearly all its force. This holds more particularly true in the larger portions of the South and West that are least adapted to dairy products, or where bee-keeping and poultry-raising are usually confined to the immediate wants of the household. In the early part of the century the females in most households, even of the well-to-do, found profitable employment in the spinning wheel and the distaff. With modern improved appliances and the general introduction of machinery the average American girl is too often doomed to idleness or else forced to leave her home to add to the family income.

4.—The want of a ready market for the cocoons is, as it always has been, the most serious obstacle to be overcome, and the one to which all interested in establishing silk culture should first direct their attention. Ignore this, and efforts to establish the industry are bound to fail as they have failed in the past. A permanent market once established, and the other obstacles indicated will slowly but surely vanish as snow before the coming spring. Owing to the prevalence of disease in Europe there grew up a considerable demand for silkworm eggs in this country, so that several persons found the production of these eggs quite profitable. Large quantities are yet shipped across the continent from Japan each winter, but this demand is, in its nature, transient and limited, and with the improved Pasteur methods of selection and prevention of disease, silk raisers are again producing their own eggs in Europe. Silk culture must depend, therefore, on the production of cocoons, and these will find no remunerative sale except where the silk can be reeled. Reeling establishments are, therefore, absolutely essential to the success of silk culture.

Now, if the mere raising of cocoons is a simple operation, the reeling of the silk is one requiring both skill, capital, and experience. There is little hope of inducing our business men to engage in the establishment of filatures so long as the reeled silk from other countries can be obtained free of duty, and this is the whole difficulty. Under a heavy protective tariff our silk manufactures have grown rapidly in importance and wealth, until during the year 1881, raw silk to the value of $11,936,865, and waste silk and cocoons to the value of $769,186, were imported at the ports of New York and San Francisco, while our manufactured goods reached in value between $35,000,000 and $40,000,000. Now the so-called raw silk thus imported to the value of nearly $12,000,000 is just as much a manufactured article as the woven goods, and its importation free of duty is as much an encouragement to foreign manufacturers, and an impediment to home industry, as the removal of the duty would be on the woven goods. Yet just so sure as you attempt, for the encouragement of silk culture in this country, to get Congress to impose a duty on the "raw" material, you will be met and overcome by the combined capital of the manufacturers, who, with their powerful organizations, can more readily influence our legislators. A protective tariff for the succoring of an infant industry is all well and good, as the masses are thereby so indirectly taxed that the tax is less noticeable; but when it is imposed for the benefit of strong and wealthy corporations at the expense of home production, it becomes monopoly, and is adverse to public interests. It matters little that the treasury coffers are overflowing, or that the manufacturers, now firmly established, could afford a reduction in profit. They hold the vantage ground, and will not lose it without a struggle.

There are left but two other ways of establishing a home market—either by getting government aid in an indirect way, or by the patriotic and benevolent efforts of private individuals. In the line of the former method, to quote from my manual: "I have urged, and would urge that Congress give to the Department of Agriculture the means to purchase, erect, and appoint with skilled hands, on the department grounds, a small filature or reeling establishment. In such an establishment reelers could be trained, and the cocoons, at first raised from eggs distributed by the department, could be skillfully reeled and disposed of to our manufacturers. A market would thus be formed for the cocoons raised in different parts of the country, and a guarantee be given to those who chose to embark in silk culture that their time would not be thrown away. All industries should be encouraged in their infancy; and for the first few years, or until the silk industry could be considered well established, the cocoons should be paid for at the European market rate, plus the cost of reeling, which would range from 50 cents to 75 cents per pound of choked cocoons This last should be looked upon as a premium offered by the government to the raisers in order to stimulate the industry until such times as the reeling might be safely left to private enterprise, when government encouragement might be withdrawn."

Meanwhile the establishment of a filature by any private individual or organization will prove a benefaction, and it is gratifying to be able to state that Messrs. Crozier & Co., of Corinth, Miss., have made preparations for reeling, and offer to purchase cocoons at Lyons prices, and that the "Women's Silk Culture Association," of Philadelphia, by the use of a good hand reel and the employment of a skilled reeler, is also able to purchase cocoons. These are beginnings in the right direction. Messrs McKittrick & Co., of Memphis, Tenn., also inform me that they have established a silk school and a filature, and are prepared to purchase cocoons; but I fear that such efforts are so far warranted only either through benevolent support, or as an aid to the general business of supplying eggs and mulberry cuttings.

The obstacles which I have set forth are none of them permanent or insuperable, while we have some advantages not possessed by other countries. One of infinite importance is the inexhaustible supply of osage orange (*Maclura aurantiaca*) which our thousands of miles of hedge furnish; another is the greater average intelligence and ingenuity of our people, who will not be content to tread merely in the ways of the Old World, but will be quick to improve on their methods; still another may be found in the more spacious and commodious of the farmers' barns and outhouses. To all interested in this industry I would, therefore, say: Go on in the good work by avoiding exaggeration and by disseminating accurate and needed information as to methods and principles. Above all we should bear in mind the admirable adage, "Festina lente." To move slowly and with caution is the only way to move surely to success in this matter.

Strength of Manganese Bronze.

The twin screws of the new English Ironclad Colossus, launched March 21, are of manganese bronze. This metal was adopted in place of gun metal, as first ordered, after a series of comparative tests of the two metals made in the presence of a representative of the Admiralty at the works of the contractors for the engines. In these tests bars of both metals, one inch square, were placed on supports twelve inches apart, and first subjected to a steady pressure applied in the middle of the bars, and afterward to impact by a weight of fifty pounds falling from a height of five feet. With a steady pressure the gun metal bars slipped between the supports or broke with a strain of 28 cwt., while the manganese bronze bars required 54 cwt. to break them. Tested by impact the gun metal bars broke with from seven to eight blows, while it took from thirteen to seventeen blows to break the manganese bronze bars. The ultimate bend of the latter was also in both cases more than that of the gun metal, thus showing fully double the strength with superior toughness. The advantages claimed for manganese bronze over gun metal are—first, a considerable saving of actual weight of machinery; and, second, that it enables a thinner and consequently a better blade to be made, offering less resistance to the water and equaling in strength the gun metal blade of greater dimensions.

The Colossus is intended to be the most formidable vessel of the British navy. She is of 9,146 tons burden. Her engines are 6,000 horse power.

Vibration of Bridges.

To the Editor of the Scientific American:

I have just read the article in your weekly issue for December 24, 1881 (having only lately received it), under the heading of "Vibration of Railway Bridges," and I agree with you; such defects as you point out have more than a tendency to ultimate destruction. You are correct in your requirement of such details as will tend in the construction of bridges to resist vibration. The vertical disturbances I will take as *nil;* but bridges—I mean other than those of masonry —as at present designed, must have a tendency to sway, and the results are what you have particularized, namely, the weakening of all joints and rivets, and the crystallization of the metal. (It was that and the dead weight of the train at a particular spot, and time, which caused the destruction of the Tay Bridge. See my articles in the *Scientific Canadian* shortly after the accident.) But all the stays and braces you could put to a structure would in no way cause that rigidity so essential to stability. You must depart from *parallelism* and *flat sidedness* in your *structures;* calculate what your bridge will bear at its center; allow the usual excess; quadruple that excess gradually to the haunches, and provide strength accordingly. If *these features* are attended to, vibration or oscillation is impossible.

I. Kilner,
Major-General Royal Engineers.

Fredericton, March 16, 1882.

How to get Rid of Water Bugs.

To the Editor of the Scientific American:

I notice that one of your correspondents asks how to rid him of water bugs. *Powdered borax* and equal parts of *pulverized sugar* will rid any house of them. They will not eat the borax alone, but with sugar they will, and either die or leave, if scattered about. This is my experience.

A Reader Scientific American.

Diphtheria.

Dr. Franklin Staples, of Winona, Minn., after an extended correspondence with physicians in most of the counties of his State, has published a report on diphtheria, in which he classes the disease as contagious and infectious, and demonstrates that it is on the increase, a fact due, in his opinion, to failure on the part of physicians in recognizing its self-propagating properties; to want of systematic nursing of patients suffering from the disease; to incomplete disinfection of premises attacked; and last but not least, to the frequent intercourse of convalescents with healthy persons. He maintains that strict regulations, rigidly enforced, are the only means adequate to cut short its career, and since individual power is unable to cope with it, urges that every city and town should devise efficient sanitary laws, and let them be enforced by intelligent medical officers, who shall also make it their duty to instruct the people in sanitary rules. To guard against contamination, he believes that filth, whether from dirty rooms, soiled clothing, defective drains and cesspools, ill-ventilated rooms, poisonous inodorous gases, etc., should be regarded as conditions which invite the disease; that the apartment set apart for the patient should be divested of all furniture, carpets, curtains, and fabrics of any kind not absolutely required; that discharges from the nose, mouth, and bowels should be carefully collected and destroyed, and that all personal clothing, bed linen, etc., should be thoroughly disinfected before being sent to the general wash. In case of death, all clothing and unimportant articles should be burnt, the body should be immediately disinfected, and put into its coffin, which should be kept permanently closed. There should be no public funeral. He prefers disinfection by chlorine gas, which is to be set free in the room. Ventilation for a number of hours should then be insisted upon. Precautions falling short of these Dr. Staples considers to be useless in preventing the spread of the infection.—*Report on Diphtheria to the Minnesota Board of Health*, 1881.

The Effect of Oil on Water.

What is regarded as a complete demonstration of the value of oil in diminishing the violence of heavy seas, was made at Peterhead, near Perth, England, March 1, by Mr. John Shields.

Having chosen Peterhead as the most suitable place for his experiment, Mr. Shields caused iron and lead pipes to be laid from the beach into the sea in front of the entrance to the harbor. A force pump was attached to the land end of the piping, and near it was placed a large barrel containing one hundred gallons of oil. On March 1, Mr Shields, having been informed by the Meteorological Office that the sea was rough at Peterhead, went thither from Perth, accompanied by several seafaring men from Dundee and Aberdeen. When the white-crested waves were rising to a height of ten to twenty feet at the harbor entrance, the oil pump was put in motion, causing the oil to spread in the bottom of the sea, and on its gradually rising to the surface, the white foam entirely disappeared, and although the swell continued, the surface of the sea was perfectly smooth, so that a ship or a small boat could have entered the dock without the slightest danger—an impossibility before the oil was distributed in the water. The experiments satisfied the shipmasters who witnessed them. Mr. Shields is willing to give any harbor board the benefit of his invention, and render assistance in carrying it out.

RECENT INVENTIONS.

Messrs. Thomas M. Righter, of Sandy Run, and Thomas R. Griffith, of Wilkesbarre, Pa., have patented an improved can for use in oiling machinery. It is designed to prevent accidental or careless waste of oil. The invention consists in the combination with an oil can of a discharge tube or nozzle extended down into the can, nearly to the bottom, and provided with a bell-shaped mouth at its lower end, and a ball valve for closing the lower end when the can is turned from an upright position.

An improved door securer has been patented by Mr. John J Tierney, of New York city. This is an ingenious arrangement of a screw and guard plate for preventing access to the screw. The guard plate is held in position by the bolt of the door lock.

Mr. George W. Johnson, of Newton, Ill., has patented a tool for removing rollers from the balance wheel posts of watch movements, one of the jaws of the tool being flattened and divided to form fingers or tines adapted to be passed between the balance wheel and the roller, straddle of the post, the other jaw being formed with a recess for the reception of the pivot of the post, so that the end of the jaw will rest upon the shoulder of the post where power is applied to the handles of the tool for forcing off the roller.

An improvement in cultivators has been patented by Mr Francis O. Williams, of North Cohocton, N. Y. The object of this invention is to prepare ground to receive seed and cultivate the plants.

A novel spring-hinged bracelet has been patented by Mr. Abraham H. Engel, of New York city. The invention consists in the combination, with the two parts of the bracelet connected by a hinge and the spring, of the lug beveled upon its opposite sides, whereby the parts of the bracelet will be held in position, both when opened and when closed, by the tension of the spring.

IMPROVED STALK RAKE.

The annexed engraving represents a stalk rake for gathering corn and cotton stalks, potato vines, and other rubbish in the field into windrows, preparatory to burning them up, and in this way cleaning the field. When it is desired to pull the roots up with the stalks the rake is drawn crossways, as the rake will then take better hold of the stalks by the roots.

To unload the rake the driver raises the handle at his right, when the rake turns over without being raised from the ground.

The rake is made from fine oak timber. The teeth, which are of iron, are 30 inches long by seven-eighths square; the head piece is 10 feet 6 inches long and 4 inches square. From twenty-five to thirty acres of stalks can be raked with one of these rakes in a day.

As a reason for burning cornstalks and all other rubbish on the field the inventor calls attention to Bulletin No. 5, published by the Interior Department, from which he quotes the following in regard to the destruction of the chinch bug: "Having made observations in reference to the habits of this insect, and finding that it wintered in the perfect state, I suggested, in 1859, burning over the infested fields in the winter as perhaps the best means of destroying them, and am still inclined to look upon it as the best practical means of counteracting those that are susceptible of general adoption." "If it is possible, therefore, to reach their retreat with fire, this will be the most effectual method of destroying them where irrigation is impracticable."

GREBE'S STALK RAKE.

Great difficulty is experienced in cultivating corn planted on ground where old stalks have been plowed under, as the cultivator will pull up the old stalks, and with them the new corn, and small grain can be harrowed under much better when the old stalks are out of the way. This improved rake affords a ready and inexpensive means of clearing the fields and getting the rubbish out of the way.

This invention was recently patented by Mr. Henry Grebe, of Omaha, Neb., who should be addressed for further information.

IMPROVED INSULATOR AND PROTECTOR FOR UNDERGROUND LINES.

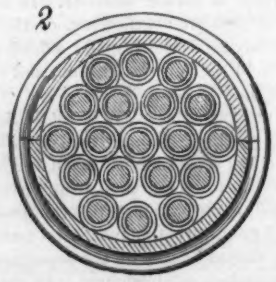
The great problem in telegraphy and telephony seems to be the disposition of the wires. Looking up from many of our New York streets, one can but wonder that the multitude of wires extending in every direction perform their function with so little interference one with another. Still the trouble caused by "crosses," breakages during storms, and by the excursions of line men in building and repairing lines, is very great, and daily increasing, and a remedy is demanded. Clearly some system of underground lines is preferable to any arrangement of overhead wires. We give an engraving of one of the latest, and apparently a very practicable device for insulating and protecting underground telegraph and telephone wires, the invention of Mr. William A. French, of Camden, N. J.

1.

FRENCH'S INSULATOR AND PROTECTOR FOR UNDERGROUND LINES.

The protector or outer casing consists of a tube of hard rubber made in ten-foot lengths and of a diameter suited to the number of wires to be used. The ends of the tubes are united by a water-tight joint. Short connecting tubes, made in halves, join the longer lengths and admit of being removed to insert or remove the conductor.

2



SECTION OF INSULATOR AND PROTECTOR.

The lengths of large tubing are filled up with smaller tubes of soft rubber, which project a short distance from the ends of the large tube into the connecting tubes, where they meet the ends of the corresponding tubes of the adjacent section, and are connected by a short coupling of hard rubber.

The small tubes are of such size as to admit of readily inserting and removing the telegraph wire. In some cases the inventor covers the wire with a protective coat of insulating material before placing it in the small tubes.

In applying the invention to practical use the telegraph wires are passed through the small soft rubber tubes of a number of hard rubber tubes, which are placed at such a distance apart that the ends of the soft rubber tubes will meet. The ends of the corresponding tubes are then connected by the small hard rubber couplings. The divided connecting tubes are then applied to the adjacent ends of the hard rubber tubes, and the coupling bands are screwed on the collar, the joints being made tight by cement or packing.

The soft rubber tubes can be made of any desired length, and can be inserted in the hard rubber tubes before or after the hard rubber tubes have been put in position, and that the half section tubes can be dispensed with in whole or in part.

MECHANICAL INVENTIONS.

An improved peanut picker and cleaner has been patented by Mr. Everitt H. Powell, of Buckhorn, Va. This invention is an improvement in that class of machines for removing peanuts from vines, and also cleaning them, which have fixed and vibrating screens and a vibrating shoe and fan blower arranged beneath the same. This inventor employs in addition to these an endless traveling apron or carrier for delivering the cleaned nuts into a receptacle provided for the purpose; but the particular feature of novelty and superiority of this machine consists in the arrangement whereby the screens, shoe, apron, etc., are operated.

An improvement in stop-watches has been patented by Mr. Charles H. Audemars, of Brassus, Switzerland. This invention consists in the use of two pinions placed between the usual pinions, by which the stop-watch hands are driven from the second hand of the watch, such two pinions fitted for being connected and disconnected with each other, and retained in either position by springs acting endwise of the arbor, with the result that the pinion gearing to the second hand arbor is continuously in motion.

A new method of locking nuts upon bolts has been patented by Mr. Albert R. Clark, of Amite City, La. It consists in first flattening one side of the bolt near the face of the nut and then casting a metal ring around the bolt, so that a portion of the ring will rest in the flattened portion of the bolt.

Mr. William S. Wood, of Denver, Col., has patented an improved ore washer, which is an improvement on the ore washer for which Letters Patent No. 209,789, dated November 12, 1878, were heretofore granted to Theophilus T. Allen.

An improvement in sleds, patented by Mr. Charles M. Amsden, of Wooster, Ohio, consists in combining with the ordinary cross bars, side rails, and seat board a metallic frame. The sled is light and strong, and in appearance is much handsomer than the ordinary wooden sled. The parts can be made almost entirely by machinery, and but little handwork is required to complete the sled.

An improved barrel stave jointer has been patented by Mr. Robert O. Dobbin, of Berlin, Ontario, Canada. In this machine the stave is carried over a circular saw by an overhanging carriage, which is swung laterally so as to give the proper curvature to the edge of the stave. The swinging is effected by an arrangement of guides on the saw table.

An improved link for horse powers has been patented by Mr. Barnard L Olds, of St. Albans, Vt. This invention relates to the means by which the lags are secured to the jointed links of the endless treads in horse powers; and it consists in loops or stirrups forming part of the links and engaging slotted lags, by which arrangement lags of uniform construction may be used and the use of bolts may be avoided.

An improvement in sawmill log-carriages has lately been patented by Mr. Morgan B. Campbell, of Beverly, W. Va. This invention facilitates the setting of logs on sawmill carriages, and renders the handling of logs in the mill a simple and easy operation.

An improved machine for dressing box straps and barrel and tierce hoops split from poles, has been patented by Mr. Samuel R. Garner, of Cassville, Wis. The invention consists in certain novel features in the feeding mechanism and in new mechanism for holding the hoop up to the cutter.

An improved baling press has been patented by Mr. Louis Ensinger, of Little Elm, Texas. This press is operated by racks and pinions, the latter being driven by worm gear. The press has a quick return motion, and has novel devices for filling and discharging.

An improvement in compass saws has been patented by Mr. Charles Bush, of New York city. The invention consists in a blade tapered from the center toward each end, curved transversely, with a curve gradually decreasing in size from the center toward each end, and pivoted at its center by a clamping screw to a handle grooved upon its opposite edges, so that larger and smaller curves can be sawed by the same saw, and a curved kerf can be continued in a curve in the opposite direction.

A novel cloth-measuring machine has been patented by Mr. Albert Winter, of Plainfield, N. J. These improvements relate to machines of the class in which revolving drums are used for measuring cloth as unwound from rolls. This invention insures accuracy by employing devices for clamping the cloth to the drum as it progresses through the machine.

An improved cultivator has been patented by Mr. Montgomery C. Meigs, of Romney, Ind. In this implement the stalks of the corn being cultivated are made to regulate the width of the cultivator.

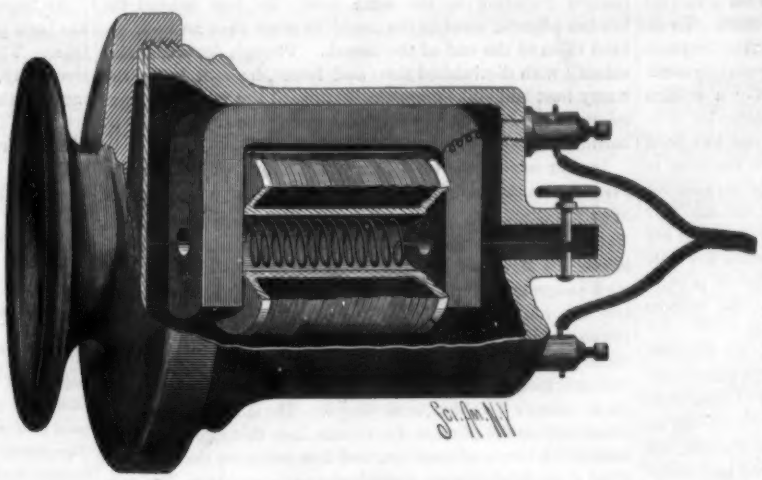
A NEW TELEPHONE RECEIVER.

We illustrate a new telephone receiver, the action of which is due to the contraction of a spiral magnet core under the influence of the current traversing the bobbin. The spiral core is attached at one end to the diaphragm, and is connected at the other end with an adjusting screw. The spiral core is perfectly free to work in the helix, and the contraction or expansion of the spiral under the influence of the current from the transmitter acts on the diphragm in much the same manner as though it was attracted by a magnet, the results being the same as in Bell's, Gray's, or Phelps' instruments.

A permanent magnet placed outside the bobbin magnetizes the "spiral core" by induction, so that the spiral is very sensitive, thereby making it sensitive to the influence of currents passing in the bobbin. The inventor expects to partially, at least, overcome the influence of induced currents in the receiver, and to obtain more distinct articulation.

The construction of the telephone will be readily understood by reference to the engraving, in which a portion of the instrument is broken away to show the internal parts. The diaphragm is mounted on a mouthpiece of the usual description, and the permanent magnet and bobbin with the inclosed spiral is placed in a small casing attached to the mouthpiece. The instrument is provided with the usual binding posts and flexible connections.

This receiver is the invention of H. S. Thornberry, of Winona, Minn., who may be addressed for further particulars.



THORNBERRY'S TELEPHONE RECEIVER.

The Legnophone.

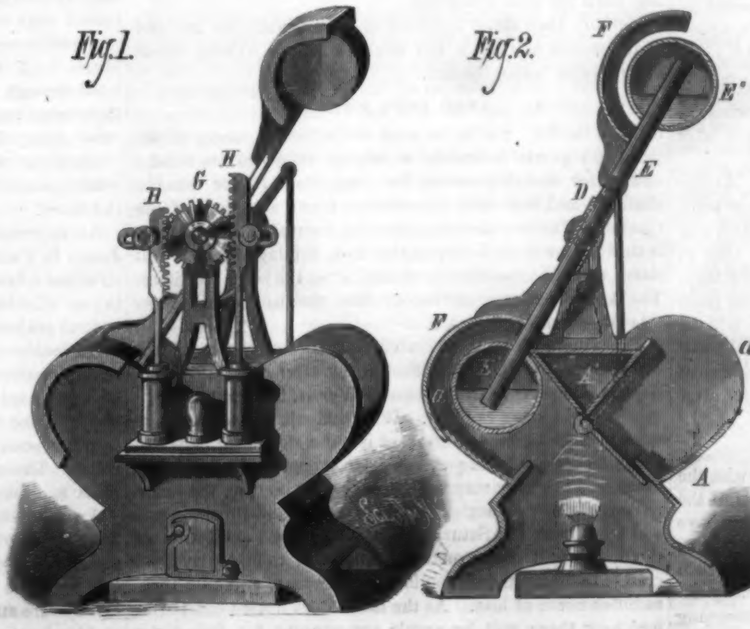
According to the *Palestra Musicale*, of Rome, Signor Lasina has invented a new musical instrument, which he calls the "legnophone, resembling the *Madera y paya*, so well known in Spain. This instrument, on the perfecting of which Signor Lasina has worked for years, is in the shape of a triangle, and consists of forty-five small rods of white poplar wood, lying each one on six short straws standing on a plank of deal. The musician strikes these rods with two sticks, as if they composed the keyboard of a piano, and plays with ease and accuracy the most difficult pieces of music. Signor Lasina intends to give a series of public concerts to introduce his legnophone to the notice of amateurs.

NOVEL MOTOR.

The engraving represents a new motor which operates by the shifting of an inclosed volatile liquid in vacuo from one chamber to another and higher chamber. The casing forming the frame of the motor is open at the bottom and at each of its upper corners. A V-shaped partition, converging downward from the top of the casing toward the lamp, divides the calorific chamber into two diverging passages or apartments, one extending from the lamp to entrance *a*, and the other to entrance *a'*. On the top of this casing are two standards, which afford bearings for a sleeve, D, rigidly secured on the middle part of a tube, E. This tube has at its ends cylindrical receptacles, E' E², and the tube and receptacles are exhausted of air and supplied with some easily-vaporizable liquid—for instance, alcohol—in sufficient quantities to partly fill them. Each end of the tube is also provided with a flanged cap, F, which extends over the adjacent receptacle and is adapted to fit about the entrance in the casing which receives the receptacle, so that when the receptacle, E', descends into entrance *a*, as shown, its cap, F, entirely closes this entrance. The heat is thus prevented from escaping, and also is reflected upon the top of the receptacle.

Trunnion, *c*, carries in front of its standard, C, a gear wheel, G, which meshes with two racks, H H, formed on the upper ends of piston rods which operate the pumps. Of course any other form of mechanism may be operated instead of these pumps by said cog wheel and pinion, or by cranks or other suitable devices.

The other trunnion, *c'*, carries a crank arm, *k*, which is connected by a long rod or pitman to a crank arm, *l*, on a rock shaft, L, journaled in the front and rear walls of the casing. This rock shaft carries a depending gate, M, which vibrates from side to side as the tube, E, oscillates on its trunnions or transverse shaft. When receptacle, E', is within the calorific chamber and receptacle, E², at its highest point, the gate, M, is in position to direct the entire body of heated air against the former receptacle. The liquid in this receptacle becomes partly vaporized; but as the end of the tube, E, is extended nearly through this receptacle, the vaporized liquid drives by expansion the remainder of the liquid before it through the tube. This results in transferring bodily and almost instantly the whole supply of fluid from the lower receptacle to the upper one. The latter then preponderates, and therefore descends to become the lower in its turn. During this descent the trunnion cranks and connecting rod or pitman above described cause shaft, L, to rock in the opposite direction, so that the gate, M, cuts off the hot air from entrance *a*, and allows it to flow to entrance *a'*. The receptacle, E², is then brought under the influence of heat, when the operation just described is repeated. The inventors state that this machine is capable of operating very rapidly. Fig. 1 is a side elevation of the motor, and Fig. 2 is a vertical section. This device was recently patented by Messrs. Anthony and Albert Iske, of Lancaster, Pa.



ISKE'S MOTOR.

Floating Soap.

A correspondent says that while passing through the Edgar Thomson Steel Company's Works recently his attention was attracted to the men washing themselves at the large tubs arranged for that purpose. What attracted him particularly was the peculiarity of the soap they were using. When one of the men had soaped himself he would drop the soap into the water and it would "bob up serenely from below" like a cork, ready for the next man to pick it up. The advantage of this soap to millmen and mechanics, who in washing make the water very dirty, was manifest, for no time was lost in fishing around the bottom of the tub for the soap, as it floated on the top of the water like a white chip. The soap was called "ivory," presumably on account of being of a creamy white color like ivory. French soapmakers have from time to time made soaps that will float, but they lacked durability and strength sufficient to stand rough usage. The prime requisite for a floating soap is that it shall be made of oils, for oil may be converted into soap that will float as well as oil in its natural form, if the soap be free from adulteration. In fact, it must be a thoroughly clean, pure article. Such a soap will make a soft creamy lather, easily rinsed off, not greasy or gummy, as is too often the case. We are pleased to note that Messrs. Procter & Gamble, of Cincinnati, have at last discovered how to make a soap that will float, and at the same time be durable and serviceable, and reasonably cheap.

High Price of School Books.

MR. R. M. STREETER, Principal of a school in Toledo, Ohio, makes some astonishing assertions with regard to the high price of school books. He says, in the *Boston Journal of Education*: "We are using four Readers of a series. To publish these Readers cost 5 cents, 11 cents, 16 cents, 20 cents; the arithmetics, 5 cents and 20 cents. Comparing the publisher's cost with the price paid by the pupil, we find on the Readers a profit of 400 per cent., 318 per cent., 368¾ per cent., 525 per cent.; on the arithmetics, 800 per cent. and 325 per cent. When the list includes all the text-books of the schools, and when it is understood that these school books are paid for at a per cent. varying from 400 to 971, it seems to be about high time for Mr. Dennis McCarthy, or anybody else, to enter a protest against this outrageous price for school-books."

More about the New Comet.

A communication to the *Herald*, dated Albany, March 22, says that the new comet is now in the constellation of the Lyre, near Vega. It will pass to the westward of that star, and about the 1st of April will stand within four or five degrees from it. It will continue on its journey up into Cepheus, when, in May, it will make an abrupt turn and go plunging in toward the sun.

The elements of the orbit of the new comet are: Perihelion passage, June 15; perihelion place, 49 deg. 35 min.; longitude of node, 206 deg. 40 min.; inclination, 74 deg. 47 min.; perihelion distance, 10,000,000 miles; motion direct.

This comet appears to have no analogue in the past, as no comet is known with elements sufficiently resembling these to constitute reasonable belief in identity. The elements of the comet of 1097 somewhat resemble those of the present comet, but the perihelion distance of the former is computed to be seven times as great as that of the latter.

At present the comet is about 160,000,000 miles from the earth, and its distance from us will probably not be less than 80,000,000 at any time, though further calculations will be necessary to settle that point. It may be expected to make a fine display for a few days in the early part of June. The present extraordinary intensity of its light, which comes to us from the enormous distance of 160,000,000 miles, proves that it has plenty of material for future display, and it will probably show a long and nearly straight tail of enormous dimensions to our antipodes. How much it will give us is still problematical.

The Dangers of Ignorance.

One cannot judge from the brief accounts given what are the precise causes of such disasters, but there is reason to believe that ignorance is prolific; that many persons have only a vague knowledge of the qualities of nitro-glycerine, cannot recognize it when they see it, and are not acquainted with the various forms in which it is compounded, or with the peculiar dangers of handling it carelessly. Nitro-glycerine itself is a dense, yellowish liquid, but in order to diminish the danger attending its use, fine earth, ground mica, sawdust, or some similar powder, is saturated with it, and thus the various blasting powders known as dynamite, mica powder, dualin, rend-rock, etc., are formed. These compounds can be transported with comparative safety. But the nitro-glycerine easily drains off from the powder and oozes from any crevice in the vessel in which the compound is kept. Drops of it thus bedewing the edges of a box may very easily be mistaken for oil escaping, and if workmen ignorantly endeavor to nail the box tighter or to open it for examination there will be a disastrous explosion. Several have occurred in past years in this way. The victims knew, no doubt, that nitro-glycerine (or the compounds) may be exploded by a blow (contact with fire is not needful), but they did not suspect that the innocent-looking oil was nitro-glycerine.

Why should not youth be taught in the schools somewhat of the practical dangers of these substances which are coming into such common use? They would pursue the study with interest, especially if there were judicious experiments. A Missouri story is that a teacher confiscated a small metal box which a pupil was playing with in school hours, and, thinking it contained chewing gum, tried to break it open with a hammer. It was a dynamite torpedo of the kind used on the railroad track as a danger signal, and large bits of it had to be cut out of the lady's cheek. Would it not have been well if she had known somewhat of the aspect of torpedoes? Was it not more important to the journeyman plumber who threw the lighted match into the pan of camphene, mistaking it for water, by which the great printing establishment of Franklin Square was burned some twenty-eight years ago, to know camphene by sight than to have memorized many of the matters prominent in a public school course? Surely workmen, especially "raw hands" in establishments where these things are used, should be systematically instructed in advance, and the courts are now enforcing this principle.—*Benjamin V. Abbott, in Popular Science Monthly.*

ASPECTS OF THE PLANETS FOR APRIL.

VENUS

is evening star, and the only one among the planets whose movements excite a marked interest during the month. She has now advanced far enough in her eastern course to be seen in the west soon after sunset, and to allow the observer to obtain a glimpse of the beauty to be revealed during her nearly ten months' course as evening star. She will soon be the brightest in radiance, the largest in size, the softest in color of the myriad golden points that glitter in the celestial archway. Neither is she to be considered alone in an æsthetic light. The Queen of the Stars has unwittingly a mission to perform, when, closing her career as evening star in December with the grand event of the transit, she furnishes the inhabitants of the planet that shines so brightly in her sky one means for measuring the unapproachable, the much-desired solution of the problem—the earth's distance from the sun.

No better time than the present can be found for a careful study of the laws that rule the movements of Venus. To an observer on the earth, as she passes from superior conjunction round to superior conjunction again, she seems to oscillate in straight lines east and west of the sun like a golden bead strung on an invisible wire. Since her superior conjunction with the sun on the 20th of February she has been advancing on her eastward track. This she will continue to do until the 26th of September, when she reaches her greatest eastern elongation or extreme distance east from the sun. She then reverses her course, drawing nearer to the sun until her inferior conjunction on the 6th of December, when her rôle of evening star is ended, half her synodic revolution is completed, and, passing to the sun's western side, she repeats the same phases in reversed order as morning star.

Any intelligent observer can verify the process for himself, and will find the beautiful star a little farther east and a little longer above the horizon every evening until the eastern elongation. If he once keep track of her movements during an entire revolution he has learned the lesson for a lifetime, for every five hundred and eighty-four days the same succession of events occurs. Thus the aspects of our nearest planetary neighbor may become as familiar as those of the sun and the moon.

Venus commences this month the series of charming celestial scenes in which she will appear as chief actor. On the 19th she is in conjunction with Saturn. As Saturn is moving westward and approaching the sun, and Venus, in his near vicinity, is moving eastward and receding from the sun, it is inevitable that they should meet and pass each other. This event, known as their conjunction or nearest approach, occurs at 3 o'clock on the afternoon of the 19th, Venus passing nearly two degrees north of Saturn. If the night be clear the two planets will make a charming picture on the twilight sky. Venus sets on that evening a few minutes before 8 o'clock. Saturn about five minutes earlier than Venus, and both of them about an hour after sunset. On the evening of the conjunction Venus must be looked for about four and a half degrees north of the sunset point, and Saturn nearly midway between Venus and the sunset point. Both planets will be found about fifteen degrees east of the sun. An opera-glass or a spyglass will be a valuable assistant in picking up the planets, for they are too near the sun and too far from the earth to appear under favorable conditions.

On the 21st Venus is in conjunction with Neptune, passing about a degree and a half north of him. The conjunction is invisible, as Neptune is never seen by the naked eye, but it proves how near Neptune and Saturn are to each other, as seen from the earth, Venus passing the one two days after the other.

Venus reaches her descending node on the 26th. As her orbit or path round the sun is inclined to the ecliptic or sun's path she must be above or below it except at the crossing points, called ascending and descending nodes. One of these points, her descending node, she reaches on the 26th. When she comes round to the same node again, after passing her ascending node in the intervening time, she will be directly between the earth and sun, and the transit will occur. Venus sets now at seven minutes after 7 o'clock; at the close of the month she sets about eighteen minutes after 8 o'clock in the evening.

SATURN

is evening star, and drawing so near his conjunction with the sun that he will fade into invisibility in the latter part of the month. He is in conjunction with Venus on the 19th; we have already called attention to this, his farewell appearance as evening star. Saturn for a season will no longer be seen among the stars, but we are reconciled to his temporary absence, for when he reappears to grace the summer morning sky he will don a more brilliant aspect than he did last year at the same time, for his northern declination will be increasing, his rings opening more widely, and his perihelion drawing nearer. All these phases will culminate between the present time and 1885. Saturn passes the meridian now two minutes before 2 o'clock in the afternoon; at the end of the month about eighteen minutes after midday. He sets about a quarter before 9 o'clock in the evening; at the end of the month he sets a few minutes after 7 o'clock.

NEPTUNE

is evening star, and gains upon Saturn as they travel toward conjunction. On the 1st of the month he passes the meridian eleven minutes after Saturn; on the last of the month he is only four minutes behind him. He is in conjunction with Venus on the 21st, but the event is not of much importance, as it is invisible. In imagination, however, Saturn and Neptune can be seen rolling their vast spheres toward the sun, while Venus, receding from the sun, passes them in her course. In reality the planets as well as the earth are revolving in elliptical orbits round the sun, while their positions in the sky result from the fact that the earth from which we view them is a moving observatory, complicating their apparent movements.

Thus Neptune is one hundred and sixty-five years in making a single revolution round the sun, while to an observer on the earth he seems to complete the circuit of the heavens in about three hundred and sixty-seven days.

Neptune now sets a few minutes after 9 o'clock in the evening; at the end of the month he sets about a quarter after 7 o'clock.

JUPITER

is evening star, and remains third on the list of the outer planets traveling to the same goal. He lags behind his brother planets, passing the meridian more than an hour behind them at the end of the month. Though departing and shining with diminished size and luster, he still leads the starry host and sinks majestically toward the west as if conscious that he is first and foremost among the sun's family of worlds.

Jupiter sets on the 1st of the month at 10 o'clock in the evening; at the end of the month he sets at forty minutes after 8 o'clock.

MARS

is evening star, and, like the trio that precedes him, making slow progress on the same road. He is in quadrature with the sun on the first day of the month, being half way between opposition and conjunction, or ninety degrees from each. He is now on the meridian at 6 o'clock in the evening, and looks down from this high elevation as soon as it is dark enough for him to be visible. He is not of much account among the planets, for he has lost the martial air he assumed when in opposition, and now takes on the aspect of a red star, shining more serenely than his neighbors, Procyon and Aldebaran, of the same color. He has passed into the sign Cancer, and after the 5th his extreme northern declination will decrease.

Mars sets now not far from 2 o'clock in the morning; at the close of the month he sets a quarter before 1 o'clock.

URANUS

is evening star and the fifth and last on the list of planets traveling to conjunction with the sun. He still shines in the reflected radiance of his last month's opposition and perihelion, and may be found by careful observers nearly in the position then indicated, in the constellation Leo. His right ascension is now 11h. 7m., and his declination 6° 29′ north.

Uranus sets about a quarter before 5 o'clock in the morning; at the close of the month he sets a few minutes before 3 o'clock.

MERCURY

is morning star and worthy of mention simply from the fact that he is sole representative of the brotherhood in the morning sky, for he is too near the sun during the month to be seen by the unaided eye. He is traveling from his western elongation to superior conjunction, rising later every morning until the goal is reached.

Mercury rises about 5 o'clock in the morning; at the end of the month he rises a few minutes after 5 o'clock, about five minutes before the sun.

THE APRIL MOON

fulls on the 3d. She is the most distinguished moon of the year, and exerts indirectly a mighty influence on human affairs, for she determines the time when Easter Sunday shall fall and thus rules the movable feasts and fasts of the Church. The law that regulates the festival, simply stated, is that Easter shall fall upon the first Sunday after the full moon which happens upon or next after the vernal equinox. The April full moon carries out these conditions and secures this pre-eminence.

The new moon of the 17th commences her course with a brilliant record. On the 18th, the day after her change, she pays her respects to three planets—Venus, Saturn, and Neptune—on the same evening. It is difficult to see the moon when a day old, for the crescent is but a slender thread, still it can be done. If the evening be exceptionally clear, the keen-eyed observer may behold the lovely picture, the moon passing about two degrees north of Venus and three degrees and a half north of Saturn. But the loveliest exhibition of the month will occur on the 19th, when the two days' old crescent will be in conjunction with Jupiter, and only forty minutes north of him. As the moon does not set until after 9 o'clock there will be ample opportunity for seeing the show, if the clouds are kind.

Telescopic observers will not find abundant material for study among the planets that play their parts on the April sky. Uranus still displays to advantage his sea-green disk; Venus retains her gibbous phase, and Mercury takes on the form of an evening moon. The outer planets have had their day. A small telescope will be of great assistance in showing the conjunction of the moon with Venus and Saturn, and also the conjunction of Venus and Saturn with each other.

April is not a field-day on planetary annals, but there are incidents enough to reward close study. Three planets, Saturn, Neptune, and Jupiter, are clustering closely around the sun. Venus, moving eastward, passes Saturn and then Neptune in her unswerving course. Six planets are evening stars, and only one represents the brotherhood in the morning sky. Two conjunctions of planets, and the moon in conjunction with three planets on the same evening, take rank as specialties. Perhaps the most marked feature of the month is that Saturn, Neptune, Jupiter, Venus, and the moon are all in the sign Taurus. According to astrologers the conjunction of the moon with Saturn, Neptune, and Venus in this sign has an ill-boding influence for the countries ruled by Taurus, and earthquakes may be looked for in the east of Europe at the time of the conjunction. But the modern astronomer looks serenely upon these portents of ill, secure in the faith that the planets in their courses have a higher mission to perform than that of ruling the destinies of this planet and determining the horoscope of those whose little lives are rounded by a few short years as we count time.

MISCELLANEOUS INVENTIONS.

An improved regulator for electric store boxes and lights has been patented by Mr. Henry B. Sheridan, of Cleveland, Ohio. This invention relates to a system of lighting by electricity, and designed to keep the lamps alight by shunting into the circuit automatically a box stored with electricity. The storage box can be charged with electricity directly from the generator, and by an automatic mechanism made to supply the lamps in circuit with sufficient electricity to keep them alight; or the storage box can be connected with the generator and the circuit in such a manner as to receive and retain the surplus electricity when more is generated than required to support the lights, and give out the stored electricity when less is generated than is required to support the lights.

Messrs. Robert M. Mason and George M. Wooster, of Bristol, N. H., have patented an improvement in the manufacture of board from wood pulp. The object of this invention is to manufacture wood pulp boards of desirable thickness and with the fibers or grain distributed equally in every direction, similar to paper and paper boards. This is accomplished by the adaptation of the Fourdrinier machine and process to such manufacture.

Mr. Gustav Speckhart, of Nuremberg, Germany, has patented a new and improved case for watches which will keep out dust and moisture and prevent damage to the glass and works in case the watch is accidentally dropped. The invention consists in a soft rubber case adapted to receive the watch, and provided with an aperture surrounded by a bead for the pendant, and an aperture surrounded by a bead for the dial, and with a circumferential bead.

An improvement in swivel buttons has been patented by Mr. Silas O. Parker, of Littleton, N. H. The object of this invention is to prevent the bar of a swivel button from sliding in the head and to hold it in any desired position, and to prevent the lower edge of the swiveled eyelet to which the head is attached from chafing and scratching the wrist. The swivel button is constructed with a tubular shank containing a spiral spring which presses upward against the bar passing through the head of the shank, which spring rests on a series of studs formed by pressing part of the shank inward. The shank is held to the material by an outer washer provided with a raised part and by an inner washer provided with a recessed part, whereby the tubular shank will be held properly, and its lower outwardly turned edge cannot chafe and scratch the wrist.

An improvement in beehives has been patented by Mr. Hugh L. T. Overbey, of Subligna, Ga. The hive is ventilated through openings in the cover, which are covered at their inner ends by wire gauze to prevent moth-millers and other insects from entering the hive. The hive is constructed so that the surplus honey frames and their combs can be readily removed and replaced by empty frames by taking off the cover.

An improved prospecting tool for miners, patented by Mr. James B. Thornton Chase, of Pueblo, Col., has the curve of an arc of a circle, and constructed with its pick portion tapering on all sides to a sharp point, and its heel made with a central projecting point.

An improved apparatus used for medical purposes, combining mechanical manipulation and electrical treatment, has been patented by Mr. John Butler, of New York city. The object of the invention is to allow of using a galvanic battery for such purpose in connection with a manipulating roller. The invention consists in an apparatus combining a roller and induction coil.

An improvement in heddle-frames has been patented by Mr. John Ashworth, of Wetheredville, Md. The invention consists in the combination with the heddle-frame having slotted side bars, the heddles, and the ordinary bars upon which the heddles are strung, of additional outer bars or rods and links and hooks or eyes for uniting the bars and connecting them with the frame, whereby the ordinary inner bars upon which the heddles are strung are prevented from bending and twisting, and the heddles are rendered easily changeable.

Mr. Henry H. Whitcomb, of Bridgeport, Conn., has patented a toy pistol provided with a figure adapted to be displayed before firing, and to entirely disappear upon pulling the trigger.

An improvement in universal joints has been patented by Mr. Edmund Garrigues, of Massillon, Ohio. This invention consists principally of a universal shaft connection, joint, or coupling, the ball of which is formed with an oil chamber, of casting the yokes upon the ball, and of the method of casting the ball and yokes whereby the journals and bearings of the coupling will be chilled.

On Energy as a Measurable Quantity.

Gravity being the most common and universal force, and also practically constant over the habitable portion of the earth, it is usually taken as the form in which to express quantities of energy. There are several units in use, but the one most generally used in England is known as the "foot pound," and consists, as its name implies, of the energy necessary to raise a weight of one pound one foot high. It will be obvious that whether we raise ten pounds one foot high or one pound ten feet high the quantity of energy expended in the two cases will be the same, viz., ten units, so that if any substance be raised the quantity of energy expended and retained by it in virtue of gravity will be represented by the weight of the substance in pounds multiplied by its height in feet. The unit mentioned in my last paper as the one used by engineers—that is, the "horse power"—is equal to 550 foot pounds per second, which means that an engine of one horse power (indicated) will raise 550 pounds one foot high per second.

Having now fixed on our unit, we can proceed to measure the other principal forces in terms of this the "mechanical unit," as it is called, which we will do more or less fully in proportion to their importance.

Momentum.—Suppose we raise a pound weight one foot high, it will, as we have learned, possess one unit of energy. If it be allowed to fall again immediately before striking the earth, this energy will obviously exist entirely as momentum. Now the velocity acquired by the weight at this moment will be eight feet per second. Hence this velocity represents a force of one unit; if the weight fall four feet the velocity will be sixteen feet per second; and if it fall nine feet the velocity will be twenty-four feet per second. Therefore, the velocities of sixteen and twenty-four feet per second represent forces of four and nine units respectively. On putting these numbers in tabular form we shall see an important connection between them, viz.,

Height in Feet.	Velocity per Second in Feet.	Units of Energy.
1	8	1
4	16	4
9	24	9

that the quantity of energy is proportional to the velocity squared; for, while the velocities are in the proportion 1, 2, 3, the energy they represent are the squares of these numbers, *i. e.*, 1, 4, 9, and that to measure the energy due to momentum in units we have only to divide the velocity by eight and square the quotient.

The velocity acquired by a body in falling is independent of its weight. Obviously also with a given velocity the energy possessed by a body is the same in whatever direction it be moving, hence, if we multiply the product obtained as described in the last paragraph by the weight of the body in pounds it becomes applicable to all cases. Thus the energy possessed by a weight of one hundred pounds moving at the rate of eighty feet per second will be $(\frac{80}{8})^2 \times 100 = 10,000$ foot pounds. Calculating in the same way the energy due to the earth's motion, we get the enormous quantity of 156,000,000 foot pounds for every pound of matter; and if the earth were to fall into the sun the energy due to the momentum acquired would be equal to that given out by the sun during 6,000 years.

Heat.—For the exact determination of the energy value of heat in terms of foot pounds, or the mechanical equivalent of heat, the world is indebted to Dr. Joule, of Manchester, and whose experiments—perhaps more than anything else—led to and confirmed the modern doctrine of energy. Now the other forms of energy being, as we know, so readily converted into heat, it will be seen how important this determination becomes; for, knowing the energy value of heat, we can, by measuring the other forces as such, immediately obtain their values.

Dr. Joule used several different methods in his experiments, the most important of which I will describe.

The apparatus consisted of a brass paddlewheel furnished with eight sets of revolving fans working between four sets of stationary vanes. The paddlewheel and vanes fitted firmly into a copper vessel containing water, in the lid of which were two necks—one for the axis of the wheel to revolve in without touching, and the other for the insertion of a thermometer. Motion was given to the axis by the descent of leaden weights suspended by strings from the axis of two wooden pulleys, their axis being supported on friction wheels and the pulleys being connected by fine twine with a wooden roller, which, by means of a pin, could be easily attached to or removed from the friction apparatus.

The mode of experimenting was as follows: The temperature of the frictional apparatus having been ascertained, and the weights wound up, the roller was fixed to the axis and the precise height of the weights ascertained. The roller was then set at liberty and allowed to revolve till the weights touched the floor. The roller was then detached, the weights wound up again, and the process repeated. This having been done twenty times, the experiment was concluded with another observation of the temperature of the apparatus.

Supposing the weights to fall freely—which they would practically do were it not for the friction produced by the paddle—they would, as we know, convert their energy of position entirely into momentum, and in consequence would strike the floor with a certain velocity representing that energy. Now, friction produces heat, so that the paddle in revolving raises the temperature of the water in the vessel, thereby subtracting a proportionate amount of energy from the falling weights and causing them to strike the floor with a greatly diminished velocity, and, as will be seen, the quantity of energy which has been converted into heat can then be readily calculated.

In these experiments corrections were made for the effects of radiation and conduction, and for the heat absorbed by the copper vessel and paddle; also for the friction and rigidity of the strings.

As the result of a great number of very accurate experiments with this and other methods, Dr. Joule found that whenever energy is spent in generating heat the quantity of heat produced is always proportional to the quantity of energy expended, and whenever work is performed by the agency of heat an amount of heat disappears equivalent to the work performed. He also established the important fact that the unit of heat (the quantity necessary to raise one pound of water 1° F.) requires for its production the expenditure of 772 foot pounds of energy. This number, 772 foot pounds, is known as the mechanical equivalent of heat, or Joule's "equivalent."

Experiments made by other philosophers on the work done by a steam engine, on the heat evolved by an electro-magnetic engine at rest and in motion, and on the heat evolved in the circuit of a voltaic battery, have given values very nearly identical to the above (Watts).

Chemical Action.—When substances combine chemically there usually occurs an evolution of more or less heat; and when this is sufficient to render the substances incandescent they are said to undergo combustion. Take, for instance, the case of a mixture of oxygen and hydrogen. They possess in virtue of their chemical attraction for each other a store of potential energy, and we may justly compare this attraction to that between the earth and a raised weight. For, as in the latter case, on releasing the weight it falls to the earth and converts its energy into heat, so on applying a light to the mixture we may imagine the atoms of oxygen and hydrogen to rush together with immense velocities, and thus also convert their energy into heat; and if we can measure the quantity of heat given out we have at once a measure of the energy due to the combination. Various instruments have been constructed for this purpose called "calorimeters" (heat measurers), their efficiency depending upon the more or less perfect communication of the entire heat produced to a given quantity of matter—preferably water. The following table gives in round numbers a few of these determinations:

ENERGY OF CHEMICAL ACTION.

With Oxygen.	Pounds of Water Raised 1° F. by the Combination of 1 Pound of each Substance.	Foot Pounds.
Hydrogen	61,000	47,092,000
Coal	14,000	10,808,000
Wood (dry)	7,000	5,404,000
Ether	16,000	12,352,000
Alcohol	12,000	9,264,000
Sulphur	4,000	3,088,000
With Chlorine.		
Hydrogen	40,000	30,880,000
Zinc	2,300	1,775,600

Some of these numbers have been confirmed by reversing the determination; thus, the quantity of energy necessary to set free one pound of hydrogen from its combination with oxygen has been ascertained. In all cases it is found that the quantity required is the same as that set free by the combination.

Radiant Energy.—The determination of the mechanical value of radiant energy is, unfortunately for us, in a very unsatisfactory state at present, owing principally to the variety of effects which it produces. Various valuable instruments have, it is true, been devised for measuring particular effects—notably those of Herschel, Draper, Roscoe, and Abney for the chemical effects; but these are not adapted for the purpose. The most perfect instrument yet devised is probably that of Pouillet's, and called by him a "pyrheliometer." It is constructed on the following principle: A shallow cylindrical box, made of silver, is filled with water, in the water is the bulb of a delicate thermometer, the stem of which is inclosed in the hollow tube which supports the cylinder. At the lower end of the tube is a disk equal and parallel to the base of the cylinder; this is for the purpose of receiving the shadow of the cylinder, and thus assisting the operator in pointing the instrument directly toward the sun. The front of the cylinder is blackened.

In using this instrument it is pointed directly to the sun for five minutes, and the increase of the temperature of the water noted. On then making the necessary corrections for radiation from the instrument, etc., the amount of radiant energy per area of the cylinder can be readily calculated. The weak point in this instrument is the assumption that the whole of the energy which falls upon it is converted into heat.

From data obtained with this instrument it has been calculated that 1,600,000 foot pounds of radiant energy are emitted per minute from each square inch of the sun's surface. Taking this to be true, a powerful electric light should emit about 80,000, a lime light about 10,000, and a candle flame 9 foot pounds per inch of surface per minute.

Electricity.—The measurement of electricity in mechanical units is very readily accomplished, all that is necessary being to pass a given quantity through acidulated water and collecting the hydrogen evolved at the negative pole in a graduated glass vessel. The volume being read off, its weight is ascertained (100 cubic inches, at standard temperature and pressure, weigh 2·227 grains); then, knowing the quantity of energy necessary to set free one pound of hydrogen to be 47,092,000 foot pounds, the equivalent is readily obtained.

It will be noticed that the unit of energy is the same as the unit of work; they represent, in fact, the same thing. Or, to quote the late Professor Clerk Maxwell, "Work is a transference of energy from one system to another." The system which gives out energy is said to do work on the system which receives it, and the amount of energy given out by the first system is always exactly equal to that received by the second. I shall conclude this article with another appropriate remark of the same eminent authority. "The discussion of the various forms of energy, with the conditions of their transformation from one form to another, and the constant dissipation of the energy available for producing work, constitutes the whole of physical science."—*E. H. Farmer, in Brit. Jour. of Photography.*

Telephones and Electric Lights in Brazil.

The *Rio News* reports a condition of things in Rio Janeiro not at all creditable to certain public officers of the empire. The Director-General of the State Telegraph Department in particular has seen fit to take a position of violent hostility to the introduction of telephones not under his control, and the indications are very strong that his hostility extends also to electric lights, while his methods of manifesting his dislike are not such as public officers commonly resort to.

The *News* says: "Ever since the telephone company of this city—which is so unfortunate as to be a foreign enterprise—began to stretch their lines from the central office to the various suburbs, there has been a systematic effort on the part of certain interested parties to impede the work and damage the property. The means usually employed is the cutting of the wires. Regardless of the fact that this is an injury to private parties as well as to the company, this contemptible work has been prosecuted not only without hinderance, but with the well known approval of influential parties in this city."

After describing at some length the course of the Director-General of the Telegraph Department in this connection, the *News* remarks:

"It is no longer a personal matter; the good faith of the government is at stake. If a privilege to a foreign enterprise is worth one straw in Brazil, then the government is bound to guard and protect it. If, however, a foreigner has no protection for his labor and investments as against the malice of influential personages, then let us know it at once. If matters go on in this way a little while longer—in the confiscation of property, the breach of contracts, the destruction of electrical machines, and the cutting of telephone wires—this country will be saddled with a reputation which will not only keep enterprise and capital at a distance, but will even drive away those that are now here. It is full time that the steady, thinking portion of this community take these occurrences into consideration, and determine where they are being led."

The destruction of electrical machines referred to occurred during the late National Exposition, the victims being the Edison electric light people, the aim being to prove that system of lighting irregular in its action and untrustworthy.

"It was thought a suspicious circumstance that two armatures in succession should be burned, but when a third was ready to be put in place, an examination of the upright columns of the dynamo developed the fact that a sharp instrument had been inserted beneath the canvas covering at their lower ends, and that the wires had been cut. That the cutting was done by an expert is clearly evident from its location and character. The damage was examined by a commission of the Engineering Club, who are satisfied that the cutting was done willfully and maliciously."

Speaking of this outrage the *News* observes:

"We have heard of no effort on the part of the Associação Industrial, in whose charge the Edison apparatus was at the time of the accident, to ferret out the guilty party Even the Director-General of the Telegraph Department, who should make every effort to guarantee fair play, does not seem to have noticed the trick. Fortunately, however, the Edison light has been placed in the Dom Pedro II. railway station, where the public may judge of its merits without interference."

American Fences.

There are six million miles of fencing in the United States, the total cost of which has been more than two thousand millions. The census reports show that during the census year, there were expended $78,629,000 alone. Of this amount the largest contribution was from Illinois; the second from Pennsylvania.

Security against Counterfeiting.

N. J. Heckmann adds five per cent of cyanide of potash and sulphide of ammonium to the sizing water, and passes the sized paper through a thin solution of sulphate of magnesia or copper. If any attempt is made to remove writing from such paper by means of acids or alkalies the tint of the paper is immediately changed. If any erasures are at tempted the coloring matter, which is only upon the surface, is removed.—*Dingl. Journal.*

only four minutes behind him. He is in conjunction with the sun. Venus, moving eastward, passes Saturn and then the coupling will be chilled.

The Plethysmograph.

This is an apparatus for detecting the variation in the size or dilatation of a body. For example, by its use the dilatation or contraction of the human hand, arm, or other organ can be ascertained. The hand or organ to be tested is placed in a vessel containing a liquid. Connected with the vessel is a test tube, a stylus, rotating cylinder, etc.

At a meeting of the Massachusetts Institute of Technology, Dr. Bowditch proceeded to exhibit this use of the instrument. For this purpose an assistant placed his arm in the apparatus, and the arm was then surrounded by water heated to a blood heat. The connections having been made, Dr. Bowditch waited until the style was describing a line nearly horizontal, and then directed the assistant to multiply twenty-three by seventeen in his head. As soon as he began to think this out, the style rose rapidly and remained up till he had finished the computation, when it fell, thus showing that during this process a certain amount of blood rushed away from the arm. When the style began again, after a minute or two, to trace a line nearly horizontal, the assistant was directed to multiply thirteen by twelve. During this process the style rose, but not nearly as much as in the former case, showing that a smaller quantity of blood left the arm in this case than in the preceding.

Dr. Bowditch then related the story that a friend of Prof. Mosso, who claimed that he could read Greek as easily as he could Italian, had his arm placed in the apparatus by the professor, who presented him successively an Italian and a Greek book to read. While reading Greek the style rose very much more than while reading Italian, and thus the instrument demonstrated that the friend was mistaken in regard to his powers, and that it was much easier for him to read Italian than Greek.

In answer to a question as to whether it could be used to study the effect of digestion, Dr. Bowditch replied that it probably could, but that the fact that digestion is exceedingly slow might present a difficulty.

In answer to some other questions, Dr. Bowditch said that the results shown by the instrument in its present state of advancement are purely qualitative, and that no quantitative determinations have been made; also, that, because we have a certain amount of blood leaving one arm during a mental process, it would not be safe to assume that the same amount left the other arm, or even to assume that the amounts of blood leaving one arm during certain mental processes were proportional to the amounts leaving the whole body.

IMPROVED JOURNAL BOX.

The improved journal box shown in the annexed engraving is especially designed for car axles, and it is claimed by the inventor a very large percentage (40 to 50 per cent) of the power required for drawing cars is saved, the effect being to practically double the propelling power of an engine. A great advantage possessed by this journal box is that it cannot become heated even at the greatest speed attainable. The construction of the box is such as to exclude dirt and dispense with the use of cotton waste. It uses only about one-fourth the quantity of lubricant consumed by the ordinary journal box. It can be readily substituted for the ordinary journal box, and as the most of the sliding friction is converted into rolling friction the journal box is practically indestructible by wear.

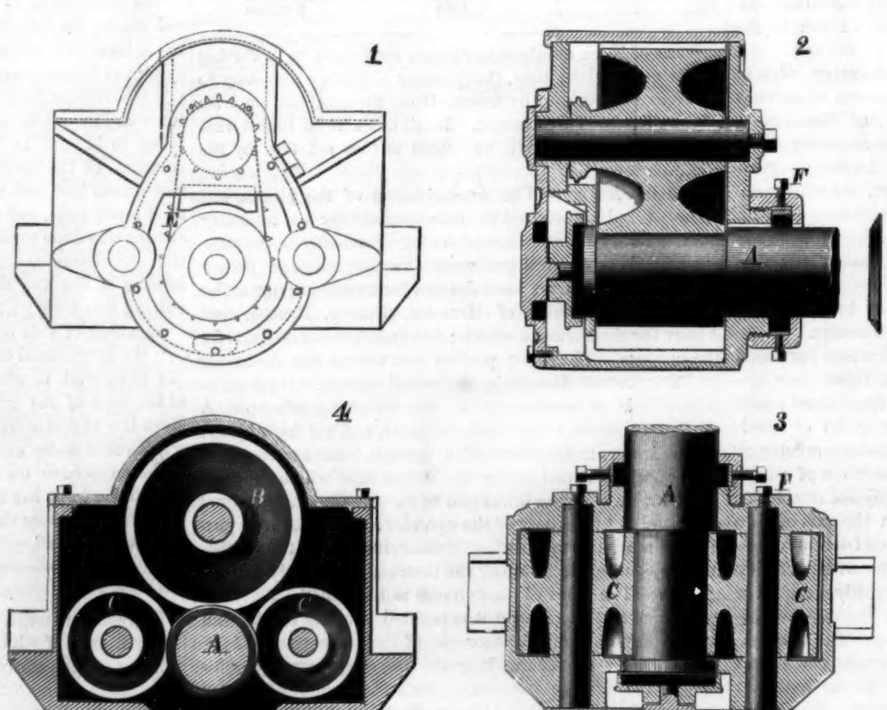
The engraving shows four views of the journal box, Fig. 1 being a side view, Fig. 2 a vertical transverse section, Fig. 3 a horizontal section, and Fig. 4 a vertical section taken at right angles to the car axle.

The lower portion of the box forms a basin containing the lubricant. The box is closed on all sides, and all of the joints are packed to exclude dust. It is divided by a vertical partition forming two chambers, the larger one containing the anti-friction rollers and journal of the axle, the smaller one containing the lubricating devices.

The smaller chamber is made accessible by the removal of the front plate, and the two chambers connect by an opening in the lower part of the partition, so that the lubricant may be at the same level in both and pass freely from one to the other.

The axle extends through a stuffing box, F, in the back plate and through the larger chamber. Friction rollers, B and C C, are placed in the larger chamber, the roller, B, being directly above the axle journal, with the two smaller rollers, C, at opposite sides of the axle, with their axes slightly above the center of the axle. The rollers turn loosely on spindles secured in the boxes. The hub of the upper friction roller projects over the oil chamber, and is toothed, forming a wheel carrying a chain provided with buckets or knobs which carry up the oil to the roller, B, insuring a continuous supply of lubricant to the roller.

This invention was recently patented by Mr. Charles E. Candee, and is owned by the Candee Anti-Friction Journal Bearing Company, 38 Dey street, New York city.



CANDEE'S ANTI-FRICTION JOURNAL BOX.

A NEW FIRE ESCAPE.

Our engraving represents the construction and use of a simple and cheap fire escape, which any one is free to make and use.

It would seem to be particularly well adapted to meet the requirements of travelers, ordinary households, and especially operatives in the upper rooms of factories.

NEW FIRE ESCAPE.

It consists of a maple stick an inch thick, two inches wide, and about fifteen inches long, and having five holes, of the size of the rope used, bored through it, as shown in the engraving. In the lower single hole is the loop for the feet, in which to stand while descending. With the upper end of the rope secured to any fixed object, the stick is held in the left hand, and the rope paid out as rapidly as desired with the right hand. With this device, which should not cost above twenty-five cents, a person may descend from any height with safety. Employers of operatives in upper stories could well afford to furnish this cheap affair to each employe, and instruct them in its use from slight altitudes.

Importation of Vegetables.

Large importations of potatoes from Europe are a peculiar feature of this year's trade, the receipts at this port amounting at times to 3,000 tons a week. The potatoes cost in Liverpool from $15 to $20 a ton, and are sold in this city at 90 cents to $1 a bushel, domestic potatoes bringing about $1.25 a bushel. Including freight and other expenses, the foreign potatoes cost about $33 a ton. Most of the imported potatoes are raised in England and Scotland, but a few come from Ireland and Germany. Those that come from the last named country are of an inferior quality and do not sell very readily. They are soft, greenish in color, and watery when boiled or baked. The dealers regard the present trade in imported potatoes as being only temporary.

The high price of cabbages—from $15 to $30 a hundred, wholesale—has led to large importations from Germany. They are brought in crates; and some sauerkraut is imported ready pickled in tierces. Turnips, celery, carrots, are also to be seen among the freight of incoming vessels. While we are importing vegetables we are exporting large cargoes of hay, that crop having been a comparative failure in England and Scotland.

Cattle Poisoned by Lead.

The *Kolnische Zeitung* remarks that in some parts of the Enskirchen district there have occurred sudden cases of illness and subsequent deaths of cattle, which have been ascribed to lead poisoning. According to the details given, it would seem that particles of ore frequently find their way into a stream which passes Clausthal, a seat of mineral industry. This metallic deposit is carried over the adjacent fields when inundations occur (which are not unfrequent). After the subsidence of the water, the lead remains on the ground and affects the vegetation. An instance is quoted of some cattle having been poisoned which had been fed upon beetroot grown upon land subject to the conditions described. The presence of lead in minute quantity (one-tenth per cent of the weight of the vegetables) was discovered by chemical analysis upon the surface of the beetroot. It is recommended for agriculturists to be cautious as to the use of vegetables, etc., which have been grown upon land subject to the overflow of any stream likely to receive particles of lead from mineral works on its banks.

Rats in Granaries.

A correspondent of the *Journal d'Agriculture Progressive* suggests a method of getting rid of these pests, that has the advantage of having been most successful in his own case It is to fill their holes with chloride of lime and oxalic acid, when a violent disengagement of chlorine takes place, their holes are filled with this gas, and they are suffocated.

Remarkable Gas Well.

In the spring of 1881, C. A. & D. Cornen were drilling a wildcat well on lot 586, Clarendon, Pa., when, at a depth of a little more than a thousand feet, they encountered a powerful vein of gas. Drilling was continued only about five feet in the gas sand, as it was very difficult to make much progress under the circumstances. All the sand rock cut by the drill was thrown out as soon as loosened from the main body of rock. Chunks the size of hens' eggs were sent up through the derrick as though shot from a cannon. All idea of an oil well was abandoned, and a project was inaugurated for utilizing the enormous amount of gas for light and fuel. A gas company was formed, with sufficient capital stock to make the venture a success. A charter was obtained, and a pipe line laid to Clarendon, a distance of three and a quarter miles. It was the company's intention to continue the line to Warren, six miles further, but winter coming on when the line was completed to Clarendon, work was temporarily suspended until spring. The well is now furnishing fuel to twenty-six drilling wells, three pumping wells, one hundred and twenty-five stoves, two machine shops, and two pump stations. Recently, on a rather cold day, the gauge in the company's office showed a pressure then of seventy-three pounds to the square inch. This gas is dry, containing no oil, gasoline, or water, and has never frozen on any part of the line, although the pipe is, in many places, exposed to the weather. An effort was made at one time to test the pressure, and the stopcock could not be turned more than half-way round, when the indicator would fly as far as possible, showing two hundred pounds to the square inch. It was feared that the casing would be torn to pieces if the investigations were

pushed further, therefore it is not known what the actual power of the gas is. The nearest oil wells are nearly two miles away, and they are very small, so the territory in the neighborhood will not likely be drilled, which will give the gas well a long lease of life.—*Petroleum Age.*

DRY STEAM PORTABLE ENGINE.

We give an engraving of an engine representing a line of portable and agricultural engines manufactured by the Taylor Manufacturing Company, of Westminster, Md. These engines are mounted on skids or on wheels, and embody many important and valuable features in their construction, which are worthy of the careful consideration of all who are interested in steam power. The engine has a rectangular frame secured to the cylinder, and supported under the crank bearings by two strong stands bolted to the frame and boiler. By this construction the boiler is relieved of the

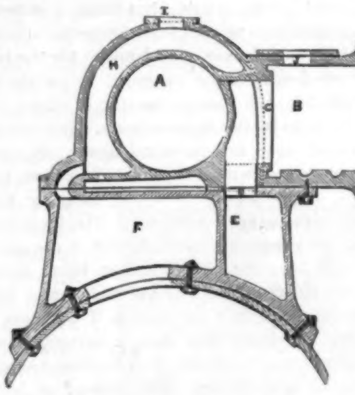


Fig. 1.—Cross Section of Cylinder, Dome, and Exhaust Chamber.

working strain of the engine, and as the crank boxes or bearings are cast in each side of the frame and on the center line through the engine, all the working strain comes on a direct line through the frame, and is distributed equally.

Fig. 1 shows the manner in which the cylinder of Taylor's patent engine is placed upon and attached to the steam dome of the boiler. It will be seen that it must necessarily be constantly surrounded by steam of the same temperature as that in the boiler, which completely protects it from cold, and prevents the condensation of steam in it.

The steam dome, F, shown in cross section in Fig. 1, communicates with the dome chamber, H, surrounding the cylinder, A. I is the opening for steam to pass into the steam chest, B, through the opening, J. C is one of the steam ports, and D is the opening for exhaust steam to pass into the chamber, E, to which the exhaust pipe is connected. The dome is of cast iron and securely riveted to the boiler, and the cylinder is fitted and bolted to it.

It will be readily seen, from the above description and explanation, that this is truly a steam engine, that it works only steam of the same temperature and elastic force as in the boiler; as a consequence, less boiler pressure is required to drive this engine than is needed to carry one in which the cylinder is exposed to outside temperature, which would condense and destroy its expansive power. In ordinary engines the only remedy for this is to carry an excess of pressure in the boiler to maintain the required pressure in the cylinder to perform the required work. By examination of the indicator card, Fig. 4, it will be seen that the steam line is well maintained throughout the stroke, and as the point of cut-off is at seven-eighths of the stroke and under a full opening of the throttle valve, it shows that there is a small percentage of loss from condensation in the cylinder; in fact, what loss there is must take place in passing through the short connection of steam pipe and in the steam chest.

The crank bearings or journal boxes are large and have gibs for quarter adjustment. The guides are the usual locomotive pattern, and the crosshead has large and ample wearing surface. The connecting rod is made of the best

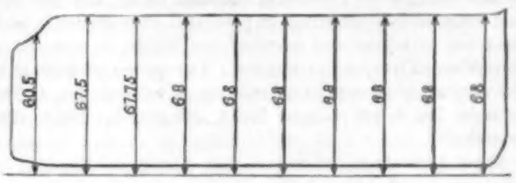


Fig. 4.—Indicator Card—Engine 10 x 18 inches: dry steam; pressure on boiler 70 lb.

hammered iron, the straps being keyed and bolted and well fitted with gun metal boxes. The box in the crank end of

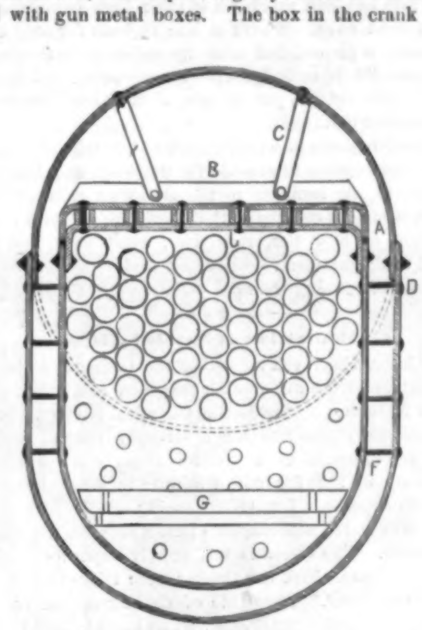


Fig. 2.—Section of Boiler through Firebox, showing Stays to the Crown Sheet.

the rod is made square to prevent rocking. The crank shaft, which is of good size, is forged of the best hammered steel. The fly wheels are heavy and carefully balanced. Much care is taken in the casting of the cylinder so as to have good wearing metal. The piston is fitted with brass and Babbitt packing rings, all joints of the rings being ground and fitted so that the rings may readily adjust themselves to the surface of the cylinder. The slide valve is of the usual D-valve pattern, proportioned on correct principles. The steam ports are large and the distance to the cylinder short, giving the best results for a quick-acting engine. Eccentric strap is made in halves, and the eccentric rod is connected to the valve steam wristpin by means of an adjustable brass box. The engine is fitted with either pump or inspirator, as is desired, and is provided with a heater that surrounds the exhaust pipe nearly through its entire length. The exhaust steam heats the feed water, and escapes through a pipe into the smoke stack. A nozzle is placed on the end of the exhaust pipe, by which the effect of the escaping steam can be regulated at will and made to produce a very strong draught if desired.

The Pickering governor used in connection with this engine is provided with a double valve that does not stick, and also with a stop motion that prevents the engine from running away in case the governor belt breaks. The speeder attachment is so arranged that the speed of the engine can be changed fifty revolutions or less without altering the size of the pulleys or stopping the engine. The engine is provided with automatic glass oilers and cylinder lubricator, a full set of wrenches, oil can, and, in fact, everything that should be found on a perfect engine. The boiler is made of the

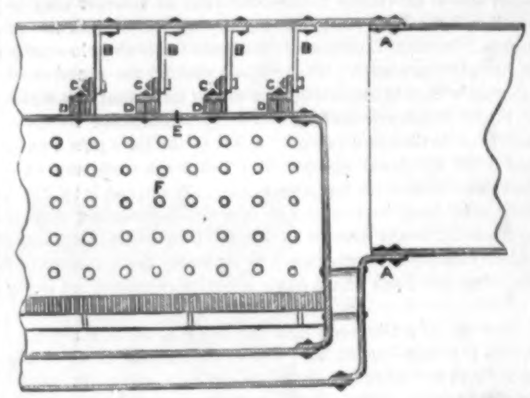


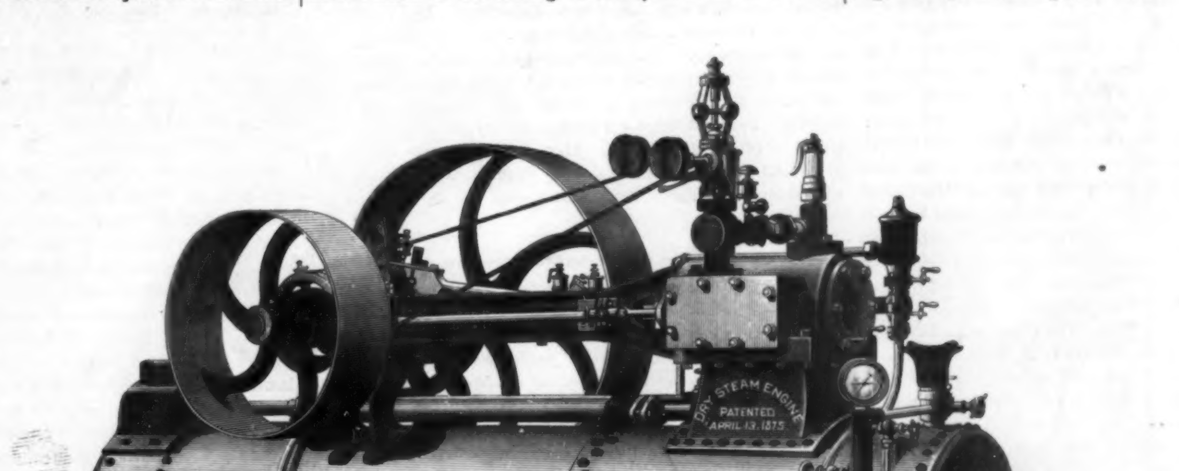
Fig. 3.—Sectional view of Fire Box, showing Stays and Crown Sheet.

best Pennsylvania charcoal iron and carefully fitted. A successful boiler is a necessary counterpart of a good engine, and no matter how well an engine may be built, if particular care and judgment is not exercised in the proportions and constructions of the boiler, satisfactory results cannot be attained from the working of the engine. There are certain particular points in the construction of a boiler that are important, perhaps the most important is the proper staying of flat surfaces, especially the crownsheet.

A careful comparison will convince most any one that that mode of staying, as shown in Fig. 2, is much the safest and best. B is a truss or crown bar, made of wrought angle iron, extending the whole width of the crown sheet, with the ends turned down and resting on the edge of the side sheets, F, of the fire box, at A, and, as may readily be seen, making a very stiff support, the strongest kind of a bridge truss, for the crown sheet. These trusses are spaced only four inches apart over the whole length of the crown sheet. In addition to these angle trusses, two braces, C, are fastened from the outside shell of the boiler to each truss, but independent of the trusses. The combining of the two makes a secure support to the crown sheets.

Fig. 3 is a sectional side view of the fire box, showing the angle trusses, C, and braces, B, arranged on the crown sheet. Washers, D, are placed between the trusses and sheet, and the two riveted together as shown, leaving ample space for the circulation of the water, thus preventing sediment and mud from collecting on the sheet. F F are the stay bolts in the sides of the fire box. There is a double row of rivets around the throat or connecting sheet of the boiler, as this requires extra staying. In the majority of the explosions that occur the rupture is at this connecting joint. E, in Figs. 2 and 3, is a safety plug, which, when the water is off the crown sheet, melts, when the steam puts out the fire. No locomotive boiler should ever be built without this plug.

The boiler is fitted with steam blower for blowing the



DRY STEAM PORTABLE ENGINE—MADE BY THE TAYLOR MANUFACTURING COMPANY WESTMINSTER, MD.

fire, three gauge cocks, glass water gauge, steam gauge, pop valves, steam whistle, steam flue cleaner, fire irons, twenty feet of smoke stack, and double spark arrester for engine on skids, and on wheels ten feet of stack hinged to lay down, or a locomotive stack, as the purchaser may desire. The engraving represents only one style or class of portable engine. In addition to this the company manufacture the well-known Utica portable engine, the Utica adjustable cut off valve stationary engine, sawmills, and the "Clipper" vertical engines.

Further particulars in regard to this engine may be obtained by addressing the Taylor Manufacturing Company, Westminster, Md.

Life and Age of a Telegraph Pole.

This subject may seem of trivial account to the great mass of business people, but when it is proved to them that it actually affects the cost and convenience of telegraph messages and of dividends to stockholders, an interest may be awakened that will make the inquiry on the subject one of unusual interest, inasmuch as it affects the high or low price of rates for messages. The original cost of the erection of telegraph lines is important, but not so important in a series of thirty or forty years as is that of its maintenance in working order during that period. Some of the lines now owned and used by the Western Union Telegraph Company were first built more than forty years ago. When one is told that they have been built three or four times since that at great expense, if would seem to lead to the conclusion that a large amount of capital is necessary to represent the actual cost of the telegraph lines which have been in existence for many years.

The size of a telegraph pole has much to do with the duty which it is expected to do—that is, the number of wires it is calculated to carry. Many telegraph companies now owned by the Western Union Telegraph Company of to day were organized and their lines built many years ago, before the organization of the "N. Y. and Mississippi Valley Printing Telegraph Company" in 1851, its name being changed to that of the "Western Union Telegraph Company" in 1856, by an act of the legislature of New York State.

The contract to build the original line required that the posts be not less than thirty feet long and twenty-seven inches or more in circumference four and a half feet from the butt, and twelve inches in circumference at the top, and set in the ground five feet. There were to be at least thirty of these posts to the mile, and they were to carry two lines of iron wire, one of which should weigh not less than six hundred pounds to the mile, and the other not less than four hundred and fifty pounds to the mile. These posts were to be of the best and most durable timber obtainable along the route they were to be stationed. These posts were intended for light lines only. When it was found necessary to increase the number of wires it was found to be necessary to have larger and more heavy poles, not necessarily much taller only in cities and large towns.

When considered apart from any local catastrophe or universal storm, the poles which were cut in winter were found to last as follows, according to the wood used, without being renewed: Cedar, 16 years; chestnut, 13 years; these are used in the Eastern, Middle, and Western States. Juniper and cypress are used in the Southern States, and redwood is used in California. Spruce lasts 7 years and juniper 15 years. If poles are cut in the summer their life will be about five years shorter than if cut in the winter. The soil in which they are set, and also the atmosphere and sunlight, have much to do with their life, for if one breaks off at the surface of the ground, or near the surface, as is usually the case, it will be five feet or more shorter than the others, and hence it is generally regarded as unfit to reset, and a new one must take its place. In some location this is provided for by having all the poles long enough to reset if they are sound enough for it to be economical to do so. The average period of the usefulness of a pole under ordinary circumstances is as above mentioned. It is seldom that mixed woods are used on a line; they are all of one kind of wood.

The official return of the Western Union Telegraph Company to the Superintendent of the United States Census, in July last, shows the following facts as to the poles used during the year: Average length of poles, 27 feet; diameter at top, 6 inches; kind of wood used, cedar, chestnut, juniper, cypress, and redwood. These poles were obtained in all parts of the United States and in Canada. The average cost of each pole delivered without freight was one dollar and two cents. All these poles were round except about one-fiftieth, which were sawed or squared. No process was used for preserving poles, and their average life, according to the wood used and the location where set, was twelve to fifteen years, and most durable wood in favorable situations did not exceed twenty-five years. The woods preferred were red cedar, white cedar, chestnut, and redwood. It is to be observed that pine and hemlock are not used. It may be remarked here that American telegraph poles make an agreeable contrast with the crooked and unsightly larch poles used in England.

The falling of a pole generally does much damage to the arms, insulators, and wires. If they were all put up new at once plain wire will last from twelve to fifteen years, and the galvanized wire used at the present day, being the best conductor, will last in the most favorable atmosphere for from sixteen to twenty years, but no longer; and where there are strains by poles or wires falling they will not last so long, and in cities and large towns, where there is much gas and moisture, it will not last more than two or three years. At all events, when a line begins to be about ten or twelve years old, and has plain wire, it is regarded as unreliable, and the safest and most economical way is to rebuild it throughout of new materials. The cost of constant repair and isolated and frequent transportation of posts and other materials, and the labor of repairs and resetting, are almost as much in a short time as it would to rebuild. The gauge of wire and the number of pounds to the mile are as follows: No. 4, 730 pounds; No. 6, 540 pounds; No. 8, 380 pounds; No. 9, 320 pounds.

From these facts we can see that a telegraph line that is thirty-six years old has been entirely rebuilt three times at least under the usual course of things, and that it may have been nearly four times rebuilt. The trunk lines of the Western Union Telegraph Company were first built more than thirty years ago, and nearly all of their lines have been rebuilt at least once. Where a line is built for only a few wires and it is proved that more are required it is then necessary to rebuild it entirely, with longer poles, and in such cases all wires are also put up new, if they are expected to be in constant use.

The maintenance in working order of a telegraph line is of continual expense to provide for the wear and tear incident thereto, the same as is the case with railroad lines, where it is always calculated that there are to be a certain proportion of new ties, rails, etc., every year, and it is charged to the maintenance account and reckoned as part of the cost of running the road.—*Journal of the Telegraph.*

Crystallization of Metals by Heat.

Some interesting facts regarding the influence of heat on the molecular structure of zinc are given in a recent paper by Herr Kalischer to the Berlin Chemical Society. Rolled zinc becomes crystalline when strongly heated, and the author recommends as a lecture experiment dipping a heated strip of zinc for half a minute in concentrated sulphate of copper solution, then washing off the precipitated copper with water, whereupon distinct signs of crystallization appear. The effect is not merely superficial; plates $\frac{1}{20}$ mm. to 5 mm. thick (no thicker were tried) proved crystalline throughout. The mode of cooling (quick or slow) has no marked influence. Zinc, when heated, loses its ring, and if bent, gives a sound like the "cry" of tin; this fact, with the crystallization, confirms the view that the cry of tin is also due to crystalline structure. Zinc must be heated over 150° C. to show crystallization on corrosion, but the "cry" is perceptible at about 130°, and increases with the temperature. As the tenacity of rolled zinc diminishes with crystallization, and the cry undoubtedly proves incipient crystallization, some important deductions for technical work are indicated. Herr Kalischer finds the ratio of the specific gravity of zinc in crystalline to that in ordinary state is 1·0004 : 1, or an increase for the former of about $\frac{1}{25}$ per cent. The ratio of electric resistance of zinc wire ordinary to crystalline = 1·0302 : 1, or a decrease for the latter of about 3 per cent. Herr Kalischer was unable to prove so fully crystallization in copper, brass, iron, and aluminum, but there were indications of it in some of these.

Cultivation of the Sumac Tree in Italy.

The leaves of the sumac tree are extensively used throughout Europe for tanning purposes, and a large amount of care and attention is expended on the cultivation of the tree in Italy, with considerable profit to the planters. It thrives best, says the *Journal of the Society of Arts*, in southern exposures and hot temperature: its life is from twenty-five to fifty years, according to the conditions of the ground, climate, and culture. It spreads through shoots rising from the bottom of the tree, and it is for this reason that plants two or three years old are selected for transplanting; the price for which they are to be obtained in Italy is 50 centimes per 100.

In preparing a sumac plantation, ditches are dug in the ground about three feet three inches apart, with a breadth and depth of about seventeen inches. In stony ground the plant is set in holes, the shoots are placed at a distance of about three feet from each other, so that every hectare ($2\frac{1}{2}$ acres) will have 10,000 trees. In digging the ditches, and more especially the holes, great care is always taken to prevent water remaining in the bottom, and when there are no other means to provide against it the ground is cut transversely. The tree does not flourish in heavy or damp ground, especially when the substratum is impermeable. The plantation is made in December, and then, during the first year, the ground is dug up from four to six times, to preserve it from weeds; manure is but sparingly used. The first digging, which is the deepest, is made in January, and the following in March, May, June, August, and October. In September of the first year the leaves are stripped off with the hands, a little before their falling. It is better, however, not to touch the young bark, but to allow them to fall off naturally. Young trees are sometimes too quickly stripped and damaged, while the crop of leaves will bring, when sold, half the price of that obtained in the following years, in which the sumac ground is dug over more frequently; this is done between December and January, and March and May, when the earth is heaped up round the stem, at the time of the first digging, and then smoothed down. In Sicily they heap up the earth among plants, cultivated as vines, to ventilate it by increasing the surface through hills, to make the running off of water easy, and to facilitate the future transplantings. In the times of the greatest dryness the hills are always leveled. In the second year open spaces left by dead plants are filled up The harvest is made when the leaves have acquired all their development and consistency and are about to change color; it takes place between July and August, yet before the month of May the leaves of the lower branches grow yellow and fall, and these are also gathered.

Usually, in collecting the crops, secondary branches are cut off, leaving only the trunk of the tree for the new buds. Some planters strip off the leaves by hand in July, and lop the trees in December, but this has the disadvantage of causing the new buds to grow too soft and the leaves too flabby. The branches are either left in bundles on the ground, for two or three days, after which they are carried to the thrashing floor; or they are brought at once to the thrashing-floor, where, after two or three days, according to the season, they are ready for thrashing, and are beaten out with flails, or by means of horses. When beaten with flails, the twig is fairer and less torn, and is sold in bales, but when trodden out by horses, it is crushed into minute particles before it is exposed for sale. When long leaves are required for the bales, the bales are thrashed early in the morning, before the heart of the day has dried up the leaves; but for crushing, the operation must be done in the hottest hours, when the branches already thrashed once are thrashed again. Square linen sheets, six feet square, with a ring in each corner, to pass a rope through, are generally used for carrying the dried branches and leaves to the storehouse. The leaves for bales are carried to the storehouses, and the rest to the mill, which is similar to that used for olives. After being ground, the large lumps are sifted out, and the branches and other impurities thrown away, and the leaves, if any, are ground again. In this work the leaf loses a seventh part of its original weight. The thrashing floor is always kept in good condition, paved and covered with cement or bricks, and the storehouse is generally exposed to the sun. When the sumac becomes old, and its verdure scanty, another crop is cultivated, and for this the vineyard is especially adapted by the previous preparation.

NEW INVENTIONS.

A novel piano sounding-board attachment has been patented by Mr. John G. Seebold, of Montreal, Quebec, Canada. The object of this invention is to provide a sounding-board attachment whereby the quantity and quality of the tones will be augmented and equalized. The invention consists in the combination with a sounding-board of an upright strip furnished with an aperture for each string between the bridge and the hitch-pin block, the strings resting against the upper edge of the apertures.

An improved floor-covering, patented by Messrs. Charles T. Meyer and Victor E. Meyer, of Jersey City, N. J., is made of a fabric covered with a coating of a mixture of ground leather or analogous fiber with mineral fiber and a binding material, such as a hard varnish. The same inventors have patented a floor covering made of a fabric covered with a coating or mixture of ground wood or other vegetable fiber with mineral fiber and a binding material, such as copal or other varnish.

Messrs. George Gregory and George Austin, of Skaneateles, N. Y., have patented an improved road-scraper which can be guided and directed very easily and can be adjusted in its inclination to the road.

An improved mechanical musical instrument has been patented by Mr. Robert W. Pain, of New York city. This invention relates to organs and other wind musical instruments which are mechanically played or controlled by means of one or more strips or sheets of paper or other suitable material perforated to represent the different notes or sounds it is desired to produce, and caused to pass automatically over air ducts or tubes, which, accordingly as they are opened by the perforations in the paper that has a valvular action relatively to said ducts or tubes, cause the reeds or other sounding devices to be played as desired. The invention consists in an arrangement by which the bellows or air reservoir is fed or exhausted, as the case may be, by pumps or feeders placed beneath the action board, the connection from the pumps or feeders to the bellows being preferably made by means of a wind trunk placed in one or both ends of the action board. It also consists of a rotating toggle-shaft connected to the hand crank of the instrument, carrying toggles arranged so as to operate in alternation their respective pumps or feeders, whereby a continuous supply of air is furnished to the air reservoir or bellows.

Mr. Justus H. Ibel, of Marshall, Texas, has recently patented an improvement in bridges which is applicable to both iron and wooden bridges, and not only facilitates the construction, but insures a strong secure structure.

An improved sluice box for use in placer mining and for working tailings from quartz mills has been patented by Mr. Cornelius Driscoll, of Pioche, Nev. The invention consists of a box containing a series of connected steps or platforms, rising one above another in horizontal planes, and provided with transverse stops or riffles, the said box being provided with a partial or complete lining of sheet copper or blankets, according to the use to which it is applied.

An improvement in platform gear for wagons has been patented by Mr. Edward Clark, of New York city. The object of this invention is to provide for trucks and wagons durable and substantial platform gear less expensive than the leaf-spring gearing generally employed; and the invention consists in a platform of novel form, supported on both light and heavy spiral springs.

MOUND-MAKING BIRDS OF AUSTRALASIA.

The mound makers are members of a small family of birds peculiar to Australia and the neighboring islands as far as the Philippines and northwest Borneo. They are allied to our common domestic fowls, which they resemble in appearance, but differ from them in never sitting upon their eggs. Some of the family, like the *maleos* of the Celebes, and the *Megapodius wallacei* of Gilolo, Ternate, and Bouru, deposit their eggs in the warm beach sand, just above high water, in holes three or four feet deep, many birds laying in the same hole. The young birds work their way out of the sand as soon as hatched, and look out for themselves without any help from their parents.

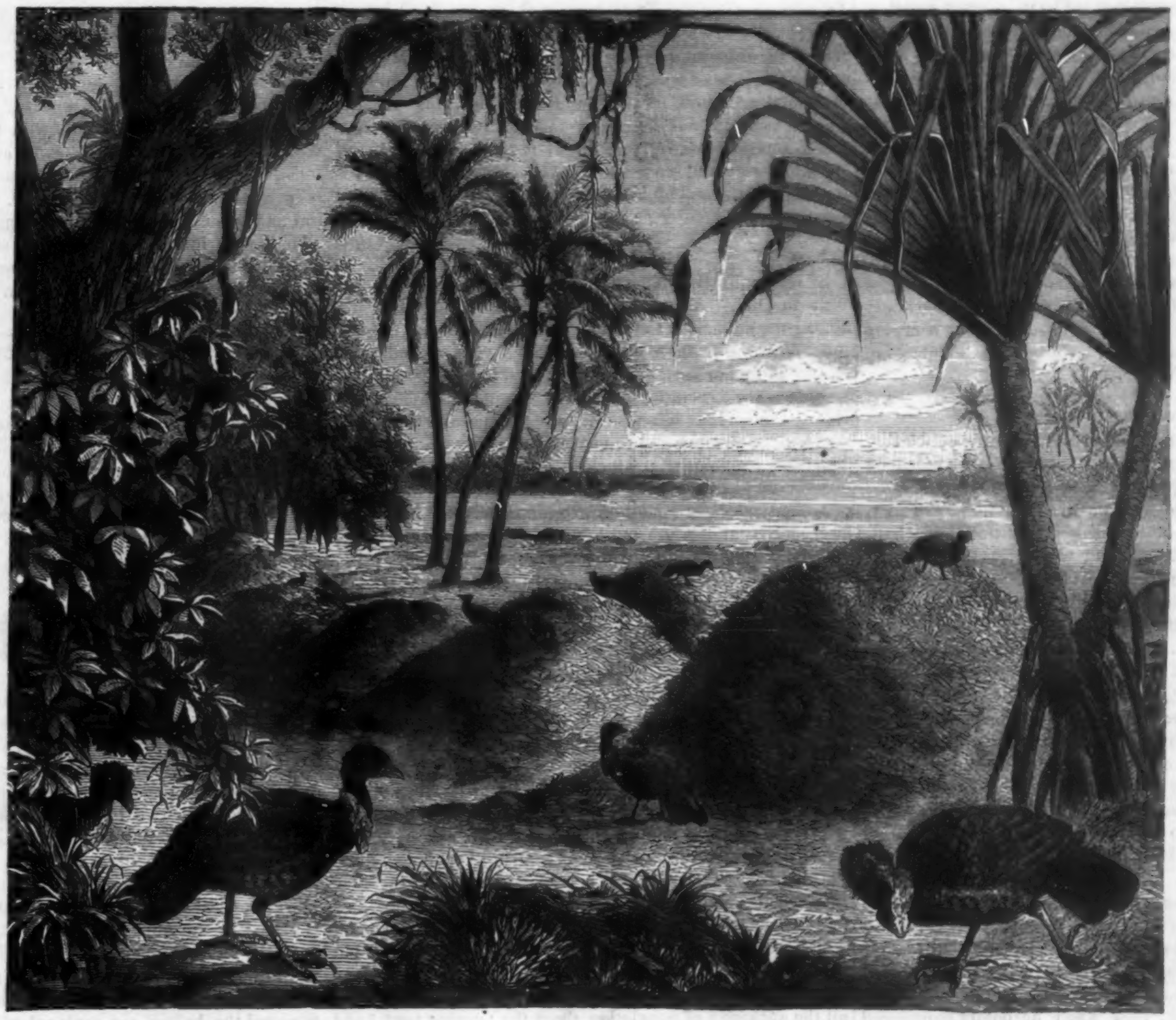
The most of the family, however, lay their eggs in mounds built of earth, stones, sticks, sea weed, and other rubbish, which they bring together with their large grasping feet. The mounds are often six or eight feet high and twenty or thirty feet in diameter. The eggs are buried in the center of the mound, at a depth of two or three feet, and are hatched by the gentle heat produced by the fermentation of the vegetable matter of the mound. In his "Malay Archipelago," Wallace says: "When I first saw these mounds in the island of Lombock I could hardly believe that they were made by such small birds, but I afterward met with them frequently, and have once or twice come upon the birds engaged in making them. They run a few steps backward, grasping a quantity of loose material in one foot, and throw it a long way behind them. When once properly buried the eggs seem to be no more cared for, the young birds working their way up through the rubbish and running off at once into the forest. They come out of the egg covered with thick downy feathers, and have no tail, although the wings are fully developed." The Lombock birds are miscellaneous feeders; other species live exclusively upon fruit.

The curious departure of the entire family of megapodidæ, or brush turkeys, in their breeding habits, from the usual habits of gallinaceous birds, Mr. Wallace traces to their peculiar organization. The eggs are extremely large for birds of their size, each egg completely filling the abdominal cavity. An interval of nearly two weeks is required before the successive eggs can be matured. Each bird lays six or eight eggs in a season, the time between the first and the last being two or three months.

Now, if these eggs were hatched in the ordinary way, either the parents must keep sitting continually for this long period; or if they began to sit only after the last egg was deposited, the first would be exposed to injury by the climate, or to destruction by the large lizards, snakes, or other animals which abound in the district, because such large birds must roam about a good deal in search of their food.

"Here, then," Mr. Wallace concludes, "we seem to have a case in which the habits of a bird may be directly traced to its exceptional organization; for it will hardly be maintained that this abnormal structure and peculiar food were given to the magapodidæ in order that they might not exhibit that parental affection, or possess those domestic instincts, so general in that class of birds, and which so much excite our admiration."

All the members of this curious family, whether laying their eggs in holes in the sand, or in mounds of their own making, would appear to be semi-nocturnal, their loud wailing cries being heard late into the night and long before daybreak in the morning. The eggs are deposited apparently at night. They are good eating, and are much sought after by the natives.



THE BRUSH TURKEYS, OR MOUND MAKERS OF AUSTRALASIA.

DR. HALEY states that he has found minimum doses of iodide of potassium of great service in frontal headache.

The Minute Size of Germs.

It is altogether beyond the power of the mind to conceive the minute size of some of the germs which in their subsequent development work such wondrous changes, and which have such important influences an health and several industrial processes. We read of the experiments of Pasteur, Tyndall, and others, but we seldom realize the infinitely small size of the organisms and germs referred to, for some are undoubtedly so minute that the most powerful microscope fails to detect them. There are some interesting remarks on this subject in a recent number of *Knowledge*, which we quote:—"The minute organisms capable of inducing changes analogous to the fermentation caused by yeast have received great attention of late years, and several important diseases are distinctly traced to them. Béchamp estimated that eight thousand millions of germs of one micro-ferment only occupied one cubic twenty-fifth of an inch. Not one of these minute bodies could develop except by carrying on complicated processes of a chemical nature, involving very active movements of its atoms and molecules.

The mathematicians have made calculations founded on the pressure exerted by the gases, and other considerations, which show that a particle of the sort of matter, such as albumen and protoplasm, chiefly concerned in life processes, contain in a space of one cubic thousandth of an inch more molecules than any one could possibly form any conception of. Sorby, taking a probable mean of such calculations, supposes one cubic thousandth of an inch of water to contain 3,700,000,000,000,000 molecules. A sheet of ordinary note paper is about one-hundredth of an inch thick. One-tenth of this would, of course, be one-thousandth of an inch, and a little square box of that size each way would hold the amazing number of water molecules mentioned. Perhaps a few thousands of such molecules may suffice for some manifestation of life, but even if many millions should be requisite for the structure of the humblest and simplest germ, we could never expect to see the actual beginnings of life."

A Right Whale in New York.

A large right whale was recently captured off Montauk Point, and brought to this city for exhibition. It is a female, said to be 70 feet long, and estimated to yield 100 barrels of oil and 1,000 pounds of whalebone. It was prepared for exhibition by the removal of the entrails, and the filling of the cavity with 90 barrels of cork chips, saturated with 22 barrels of preserving fluid. The whales previously brought to this port for exhibition have been white whales or fin back whales.

PLATINUM CRUCIBLES, on being ignited, suffer a greater or less decrease in weight when they are new, but after repeated ignition such changes no longer occur.

Notes about Snakes.

A serpent's first instinctive impulse of self-preservation, like that of every other animal, lies in escape; probably a more nervous creature does not exist. If surprised suddenly, or brought to bay at close quarters, it may be too terror-stricken to attempt flight; then it *bites*, following a curious general rule which seems to obtain throughout nearly the whole animal world, from a passionate child downward, no matter what the natural weapons of offense may be. Young *Felidæ* will keep their talons sheathed until they have exerted all possible force with their soft milk-teeth, and a lizard will seize the hand which restrains it with its insignificant little jaws, when its tail or claws might inflict far more injury. The *Boidæ* never use their constrictive powers in self-defense (unless they are griped), and it seems probable that if a venomous snake's fangs lay in its tail, it would use its teeth *first* when attacked, before bringing them into play. Indeed, it must be remembered that very few animals are provided with exclusively defensive weapons, and that the python's enormous strength in constriction, the viper's poison apparatus, the lion's teeth and claws, and the electric discharge of the gymnotus are given them primarily for the purpose of securing their food.

A snake *runs* away, walking along on the points of its numerous ribs with a rapidity which can only be appreciated by those who have seen a long one—*Herpetodryas*, for instance—escaping in the open field or over the bushes when alarmed, its speed being further increased by the body being drawn up at intervals into folds, which, being extended, shoot the head forward. This is the swiftest mode of progression of which a snake is capable, and is, as I have said, difficult to be realized from the spectacle of these reptiles in cages; the Brazilian neck-marked snake (*Geopytas collaris*), at the Zoological Gardens, will perhaps convey some idea of it, being certainly the most agile denizen of the Reptile House. But this movement is only an increase of the same action which is observed in one creeping slowly along, displayed to best advantage when it is gliding from a plane to a raised surface.

When a snake is in imminent danger, however, it adopts a remarkable motion for the purpose of eluding injury or capture, which motion, though it may be termed, *par excellence*, "serpentine," has, singularly enough, been very little commented upon by ophiologists.

The body is thrown laterally into a series of deep curves, which alternate so quickly from convexity to concavity that it is extremely difficult to touch or aim a blow with precision at any part of it, the lateral movements covering a square of ground, the side of which would be represented by at least two-thirds of the snake's length. This motion is clearly protective in its object, and is only exhibited when the straight onward movement is felt to be insufficient to avoid peril, since the reptile's speed in traveling is greatly retarded by it—necessarily so, as the head turns alternately from side to side at an angle of fully a hundred and twenty degrees to the line of its course, thus describing the major part of the circumference of a series of circles which the body and tail follow. Even a small one on a table will not be picked up without two or three ineffectual efforts, when it wriggles in this way, and I have seen a tiny *Ozyrrhopus doliatus* defend itself so for some moments against the lightning "dabs" of a serpentivorous bird; while a lively whip snake, which was cruelly thrown to a peccary in my presence, actually twined away among the hog's feet and escaped into the jungle, in spite of the hungry and active animal's attempts to secure it. I was walking in the Botanical Gardens of Rio de Janeiro some time ago, when a lady called my attention to something going away among the ferns. Not being able to see it

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strains by poles or wires falling they will not last so long, and in cities and large towns, where there is much gas and

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tion consists in a platform of novel form, supported on both light and heavy spiral springs.

from where I stood, I jumped down the bank, and found myself literally upon an immense green tree snake, at least nine or ten feet long; I was almost treading on it, but notwithstanding my most energetic efforts to catch such a magnificent specimen with my hands, feet, and the crooked handle of an umbrella, it succeeded in crossing an open space two yards wide and disappeared into a clump of bamboo, solely by virtue of this lateral movement. I noticed that the intensity of the curvatures caused the ventral plates to be exposed, so that the yellowish under color was visible at each contortion; owing, no doubt, to the interlocking of the vertebræ, and consequent expenditure of the excess action in rolling.

This serpent, of course, was harmless, so that there would have been no danger in grasping it; but it emitted a curious sound in its terror, such as I have never heard before or since. It *screamed*, and so loudly, that some people near, who saw nothing of what was going on, thought they heard a child cry. A snake's hissing, the only vocal expression of which the *Ophidia* are naturally capable, is produced simply by the rush of air through the narrow chink by which the trachea communicates with the pharynx, without any complex vibratory apparatus such as exists in mammals, though this may be prolonged for a considerable time on account of the enormous capacity of its single lung. I infer, therefore, that this one had just swallowed something, and that either its windpipe was not properly retracted to its normal position, or that the glottis was partially occluded by a pellet of mucus or (more probably) a filament of some extraneous material, which thus converted the hiss into a sort of whistle—just as boys produce a hideous screech by blowing forcibly on a blade of grass held edgewise between the applied knuckles of their two thumbs. Serpents make all sorts of noises besides hissing, according to their different kinds; Crotali spring their rattles; the carpet viper (*Echis carinata*) rubs the imbricated scales of its adjacent coils together; the fer-de-lance (*Trigonocephalus lanceolatus*) is said in St. Lucia to give out a series of little taps with its horny extremity; and many others—such as the rat snake (*Spilotes variabilis*) of South America—certainly indicate their presence when angry by quivering their tails against the ground; but a crying snake would have been a decided novelty in one's collection. *—Arthur Stradling, in Nature.*

The Mammoth.

At a recent meeting of the California Academy of Sciences Professor Henry A. Ward read a very interesting paper on "Mammoths," referring more particularly to the *Elephas primigenus*. One specimen of this, as "restored" by Mr. Ward, and now on exhibition at the Mercantile Library hall, San Francisco, is 16 feet high, and whose length, including the forward curve of the tusks, was 26 feet or more. The remains of the mammoth are among the earliest animal remains now found, and are noted by writers B.C. 300, who speak of their discovery. Some curious mistakes occurred among those who found the large bones of these animals, and mistook them for antediluvian giants. Such bones brought to ancient Rome were believed to form part of the skeleton of Pallas, and are recorded as being as high as the city walls when set up erect. Later, at Lucerne, in Switzerland, such bones were exhibited as those of a man 19 feet high. As late as February 13, 1638, the same thing was done in France, and also Scotland rejoiced in the skeleton of an antediluvian giant 14 feet high. Later, the mammoth was supposed to be the behemoth of the ancient Hebrew Scriptures. In 1696, the bones of one were collected, and mounted by learned professors and anatomists at Gotha, in Germany, who declared it was not an elephant, but the one they had was simply a *lusus naturæ*. It was finally reserved for that great French naturalist, George Cuvier, to dispel the darkness in January, 1796, when he boldly announced that all such bones were the remains of fossil elephants, differing from any now living upon earth. They have now been found all over the continent of Europe, in the pliocene and post-pliocene strata. In Asia there are vast quantities of such bones found on the northern limits of the continent, within the arctic circle. Siberia, along the Yenesei and Lena rivers, emptying into the Arctic basin, the Liakow or New Siberian islands, and the bed of the Arctic Ocean, crossed by the crew of the Jeannette in their retreat to land, all are said to be thickly covered with bones of this class, abounding in fossil ivory. Many huge masses of bones have been piled up by freshets from rivers running northward and emptying into the Arctic. Huge masses of this ivory are annually shipped to England and there cut and utilized in the arts and manufactures. The Yakouts, or natives of that part of Siberia, formerly supposed these enormous animals to be a species of huge moles, that lived and burrowed under ground, and because their remains were found beneath the surface, they thought they lived and died there. The word mammoth is a native Yakout word, meaning in their language "an animal that burrows under ground"—and the world has adopted it as a popular word. They are most abundant in the far north, and become less and less frequent as the distance from the Arctic basin increases. Professor Ward thought their long black hair and thick skin would enable them to exist in a temperate and, perhaps, a frigid zone. A mammoth was discovered frozen in latitude 72°, near a river, with his flesh frozen, and skin in place. In 1772, in latitude 64°, on the river Lena, a whole rhinoceros was discovered. In 1799, a Tungusian fisherman discovered in latitude 70°, near the mouth of the Lena, a dark mass in a block of ice, but it was too deeply embedded to get at it. In 1804, he returned to the spot and found the ice block rent and fissured. The perfect mammoth had fallen out by its own weight. The hide was heavy, and had over it thin but long black hairs. The Yakouts fed their dogs upon its fresh meat, and white bears and Arctic foxes also joined in the feast. Branches or the woody twigs of trees were found undigested in its stomach, when, in 1808, a British traveler and scientist visited the carcass. He collected the bones, took 40 pounds of black hair and one side of its hide, which he transported fully 7,000 miles to St. Petersburg, where they were purchased by the Emperor Alexander for 8,000 rubles, and deposited in the Imperial Academy of Sciences there. They have since been set up, and pieces of the skin and hair have been donated to the Paris Academy of Sciences, and to the Royal College of Surgeons, in London. Professor Ward said there were two hypotheses entertained by scientific men in regard to how these animals came there in such large numbers. One was the hypothesis of a complete change of temperature by a sudden cataclysm; and the other, the gradual depression of the land, continuing through ages. In Europe the mammoth seems to have been coeval with early man. On the tusk of a mammoth found in a cave at Dordogne, in France, is carved with a flint implement a good likeness of a mammoth. Their remains are found more or less on every continent except Australia, which many geologists consider of recent formation. All our American valleys appear to have had their great herds of such elephants, which have now disappeared from our soil. Nearly 30 different varieties have been found. In Missouri a stone arrow head was found embedded under the shoulder blade of a mammoth now in the British museum. At Racine, Wisconsin, was found an ancient drawing of a mastodon, certainly drawn from life by men. Over a bushel of chewed twigs and succulent branches was taken from the stomach of the one found in the block of ice at the river Lena.

Man a Fruit Eater.

In reviewing Miss Kingsford, M.D.'s book, "The Perfect Way in Diet," *Knowledge* remarks: Man's nearest of kin among the animals is the ape. This is shown not only by those outward features which all can recognize, but more clearly and more certainly by the structure of the nervous system. The animal in which this system resembles most closely the nervous system in man is the ape, and of all apes that which comes nearest to man in this respect is the orang. The brain convolutions, which in rodents (gnawing quadrupeds—rats, squirrels, etc.) and edentates (toothless quadrupeds—ant eaters, ground hogs, etc.) are very simple, in the flesh eating animals are more developed, and in the apes, especially the orangs, they are developed still more fully. "We are authorized in concluding," says Professor Mivart, "that the difference between the brain of the orang and that of man, as far as yet ascertained, is a difference of absolute mass; it is a difference of degree, and not of kind."

Starting from this relationship, Miss Kingsford, in the book before us, proceeds to indicate the bearing of man's kinship to apes on the vexed question of man's proper or natural food. Carefully studying the entire digestive apparatus of animals and men, and especially comparing this apparatus in men and apes, she is led to the conclusion that man approaches nearest in this respect to those animals which are eaters of fruits and herbs. "If," she says, "we have consecrated to this sketch of comparative anatomy and physiology a paragraph which may seem a little wearisome in detail, it is because it appears necessary to combat certain erroneous impressions affecting the structure of man, which obtain credence not only in the vulgar world, but even among otherwise instructed persons. How many times, for instance, have we not heard people speak with all the authority of conviction about the 'canine teeth' and 'simple stomach' of man as certain evidence of his natural adaptation for a flesh diet? At least we have demonstrated one fact, that if such arguments are valid, they apply with even greater force to the anthropoid apes—whose 'canine' teeth are much longer and more powerful than those of man—and the scientists must make haste, therefore, to announce a rectification of their present division of the animal kingdom in order to class with the carnivora (flesh eaters) and their proximate species all those animals which now make up the order primates (men and apes). And yet, with the solitary exception of man, there is not one of these last which does not in a natural condition refuse to feed on flesh!" Pouchet says that all the details of man's digestive apparatus, as well as his dentition, are proofs of his frugivorous (fruit-eating) origin. Professor Owen agrees that the close analogy between apes and man demonstrates his frugivorous nature. So also do Cuvier, Linnæus, Lawrence, Bell, Gassendi, Flourens, and a host of other authorities.

Yet another belief is as common as it is erroneous, namely, that "flesh food contains the elements of physical force, and that to be strong, robust, and endowed with muscular energy it is necessary to partake largely of animal food." Yet no flesh-fed animal rivals in strength the herb-eating rhinoceros; in endurance, the horse, the mule, or the camel. A gorilla feeding on fruits and nuts is more than a match for the far heavier lion. "The buffalo, the bison, the hippopotamus, the bull, the zebra, the stag, are types of physical power and vast bulk, or of splendid development of limb. Only in ferocity are flesh-eating animals superior (?) to those who find their food in fruits and herbs."

As regards man himself, the idea that the flesh eaters are the most powerful is erroneous, as is the cognate idea that to acquire strength a man should eat daily large quantities of flesh meat. "In the palmy days of Greece and Rome, before intemperance and licentious living had robbed those kingdoms of their glory and greatness, their sons, who were not only soldiers but heroes, subsisted on simple vegetable food, rye meal, fruits, and milk. The daily rations of the Roman soldier were one pound of barley, three ounces of oil, and a pint of thin wine. It was no regimen of flesh that inspired the magnificent courage of the Spartan patriots who defended the defiles of Thermopylæ, or that filled with indomitable valor and enthusiasm the conquerors of Salamis and Marathon." Among the nations of to-day, also, we find the fruit eaters and herb eaters as enduring, to say the least, as the flesh eaters—and healthier.

Are we then to infer with our author that a diet of fruit and seeds, preferably uncooked, is the best for the human race? Or, if we infer this, may we conclude that all would do well to adopt such a diet? It might be unsafe to accept the latter inference, for habit and custom count for something in such matters. But we may very safely adopt the opinion, now generally prevalent among experienced physicians, that fruit and seed, herbs and vegetables, should form a larger proportion of our food than they do. Precisely as many who do not accept, in its entirety, the views of Dr. Richardson about alcoholic stimulants, yet hold that these stimulants, if taken at all, should be taken in much smaller quantity than is customary, so, many who would not agree with Miss Kingsford, that animal food should be entirely displaced (which is Dr. Richardson's opinion also), yet see that it would be well if flesh meat were taken in much less quantity than at present.

How much custom has to do with the use and effects of flesh meat is shown by cases such as Miss Kingsford mentions, in which persons unaccustomed to flesh meat have been actually intoxicated by its use. Dr. Dundas Thompson tells us of some Indians accustomed to vegetable food, who, dining luxuriously on meat, showed an hour or two later, by their jabbering and gesticulations, that the same effect had been produced upon them as if they had taken some intoxicating spirit or drug.

On the Refining of Low Grade Butters.

BY NELSON H. DARTON.

Some two years ago some parties engaged my attention to investigate upon an original and patentable process for the working over of old rancid butters, scrapings of tubs, etc., which can, as a rule, be bought at from five to ten cents per pound, and by a readily executed process, which would not cost over three cents per pound, produce an article which could at that time be sold for from twenty to twenty-five cents per pound, and bringing into use a machine they had recently patented for blending different butters, etc. I commenced the series of investigations, and, after considerable experimenting, arrived at the process detailed below.

The apparatus consisted of a wooden cylinder about six feet long and three in diameter, set upon a stand, and having an opening above. Through this cylinder passed a shaft bearing a large number of steel knives about fifteen inches long, and set in every direction. This was capable of rapid revolution by means of a pulley connection, and the knives are supposed to come in contact with every particle of butter. There are two inlet tubes, one at the bottom, the other at the top, and two corresponding outlets covered with linen gauze to drain off the water. These machines may be made to hold one thousand pounds. In this size, however, eighty pounds of butter with three gallons of water is placed in this apparatus, and the knives rapidly revolved until the mixture is perfect. A strong head of water is then run through the butter for about twenty minutes, the knives meanwhile mixing the butter. When the salt is thus all removed the knives are replaced with wooden beaters, the apparatus tightly closed, and a brisk stream of chlorine from manganic oxide and hydric chloride passed through the agitated mixture for about fifteen minutes; this is then partly displaced by blowing air through, and then entirely washed out with water as before. The butter now is in a thick cream with a slight peculiar flavor. The steel knives are then replaced, four pounds of fir chips and sufficient turmeric or color added, and these thoroughly mixed in by the knives. The lower tap is then opened, the water allowed to drain off, and the butter, after caking it together, removed and placed in a linen bag. This is placed in a zinc cylinder having a perforated bottom; from here the butter is pressed out into a receptacle below by hydraulic or other pressure, and, after salting, pressed into tubs for sale.

The product is an excellent cooking butter in most cases, and often well fitted for the table, having a deliciously fresh dairy flavor imparted to it by the fir chips, and containing no traces of free chlorine, thus making it pure and wholesome. The peculiar fatty acids imparting the flavor to dairy butter, and so prone to rancidity, have been here removed, and the butter may consequently be kept for a long period without damage, and may also be heated in cooking without acquiring a tallow flavor. In these two respects it is similar to well made oleomargarine.

The only difficulty encountered in this manufacture is the variability of the raw material, and as it is generally filled with salt, water, rags, chips of wood, nails, and everything else, thus entailing a great loss beyond the two cents per pound for refining. The only advantage then to be had is to produce a fine butter by these processes and get good prices for it. The process above surely does turn out fine butter, but the profit is very small.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

OFFICE OF H. K. & F. B. THURBER & Co.,
West Broadway, Reade, and Hudson Sts.,
New York, March 15, 1882.

H. W. Johns M'f'g Co., New York:

DEAR SIRS: After an experience of over five months with your pure Asbestos Packing in use as a piston packing, I am free to say I am agreeably surprised at the result, for after being in constant use that length of time it shows little or no signs of wear, holds steam and water perfectly, does not "blow out," and I find requires less oil than any other packing I have ever used. I shall continue to use it in all the engines under my charge.

Yours truly, CHAS. D. DOUBLEDAY, Chief Engineer.

Drop Forgings of Iron or Steel. See adv., page 188.

Patent Key Seat Cutter. See last or next issue.

Latest and best books on Steam Engineering. Send stamp for catalogue. F. Keppy, Bridgeport, Conn.

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

Portable Hoists; double the power and one fourth the cost of any others. L. Hoffman & Co., 229 River St., Cleveland, O.

Patents Sold, Leased. Correspondence solicited. Inclose stamp. Kochendoerfer & Urie, 200 Broadway, N. Y.

Heavy Trimmed Walrus Leather, by the Hide or in Wheels, for Polishing Metal. Greene, Tweed & Co., N. Y.

Wanted 100 tons of Casting, in pieces weighing from 3 lb. to 300 lb. each. Any one prepared to do this will find a good and constant customer. H., Box 773, New York.

The New System of Bee Keeping.—Every one who has a farm or garden can keep bees on my plan with good profit. *Illustrated circular of full particulars free.* Address Mrs. Lizzie E. Cotton, West Gorham, Me.

Cheapest and best Hoists. 229 River St., Cleveland, O.

Blake's Belt Studs. The strongest and best fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

Now Ready. Catalogue of Electrical Books; also general catalogue. E. & F. N. Spon, 446 Broome St., N. Y.

Send name and address to Cragin & Co., Philadelphia, Pa., for Cook Book free.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N. H.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Send for Pamphlet of Compilation of Tests of Turbine Water Wheels. Barber, Keiser & Co., Allentown, Pa.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N. J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Saw Mill Machinery. Stearns Mfg. Co. See p. 156.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S. C. Forsaith & Co., Manchester, N. H., and N. Y. city.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Improved Skinner Portable Engines. Erie, Pa.

Supplee Steam Engine. See adv. p. 157.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 173.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 173.

4 to 40 H. P. Steam Engines. See adv. p. 174.

The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 174.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 188.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Paragon School Desk Extension Slides. See adv. p. 190.

Brass & Copper in sheets, wire & blanks. See ad. p. 189.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 189.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Granville Hydraulic Elevator Co., 1193 B'way, N. Y.

For Mill Mach'y & Mill Furnishing, see illus adv. p. 188.

Upright Self-feeding Hand Drilling Machine. Excellent construction. Pratt & Whitney Co., Hartford, Conn.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) E. E. asks: Of what is gasoline made, such as is used in street lamps and gasoline stoves? A. Gasoline is one of the first products obtained when petroleum is submitted to distillation and the vapors passed through tubes chilled by surrounding water. These products are as follows:

	Limits of gravity, Baume.	Average gravity, B.	Specific gravity.	Boiling point.
1 Gases uncondensed				
2 Cymogene	115° to 105°	110°	600	32°
3 Rhigoline	105° to 95°	100°	625	65°
4 Gasoline	95° to 80°	87°	664	120°
5 Naphtha (refined)	80° to 65°	73°	700	175°
6 Benzine	65° to 60°	63°	730	250°
7 Kerosene, or burning oil	60° to 38°	46°	807	340°
8 Lubricating oil (common)	38° to 25°	30°	885	425°
9 Paraffine				

(2) B. F. S. writes: Please state the formula for making glue (which is not sweet) that will dissolve without the aid of heat, as in the so-called mouth glue. A. Try the following: soak good white glue in a little cold water over night, then dissolve it by aid of heat (over a water bath) in a sufficient quantity of strong acetic acid. It does not gelatinize on cooling.

(3) C. G. S. asks: 1. What can I do or apply to polished steel, either tempered or draw the temper, and have it to maintain its brightness or high polish? A. The only way to preserve the brightness of finished steel is to protect the surface of the metal from the action of moist air. The best way to do this is to coat it with a film of some transparent lacquer and harden the latter by heat. 2. What can be applied to gold alloys and silver as a preventive of discoloring? A. The only resource is lacquer. 3. Do you know of any villages that offer large inducements to receive manufacturing enterprises? A. No. 4. Can steel springs be soldered, both ends to meet as broken, and be used for the same purpose as before? A. This cannot be done satisfactorily.

(4) W. H. M. writes: 1. I am thinking of obtaining power to run my printing press from a steam power 40 rods away. Can I use a cable made of annealed steel wire (same as used on self-binders) twisted into a rope, say five or six strand, to advantage? Will it not rust out in a short time if not coated? A. You can convey the power by a wire rope, but do not use annealed iron; use either fine iron or steel wire unannealed. 2. Is there not something that it can be coated with, say, asphaltum paint, or something of the kind? A. Coating occasionally with linseed oil and ocher, or coal, tar, or asphaltum paints, will protect it. 3. What size of wheel should it run over to give and receive the power? A. The larger your pullies, the longer the rope will wear. They should be at least three feet in diameter.

(5) C. C. C. writes: I would be very glad to have an opinion from your valuable paper (which is an authority in our family) on the healthfulness of that most common article of diet in every household, raised bread. 1. Is it a myth, or is there some truth in the often expressed saying, that "freshly raised bread is unwholesome?" If it is, I am sure your paper can give us a scientific explanation of it. A. Raised bread is not unwholesome if properly baked. If underdone the yeast is not all killed; the live cells set up fermentation in the stomach and give rise to dyspeptic troubles. 2. Why are hot soda biscuit said to be unwholesome? Are they more or less so than hot raised biscuit? Has the "heat" anything to do with it in either case, or is it only the freshness? A. Hot soda biscuit may be unwholesome when an excess of soda is used, or when the biscuit is underdone. In the latter case the doughy mass is swallowed in lumps which the gastric juice cannot easily penetrate, and digestion is seriously retarded. If baked until firm (so that it cannot be compacted like dough) hot bread is not unwholesome. The heat is not injurious; neither is the "freshness." 3. Why do we not hear the same cry against that modern breadstuff hot "Graham gems," made from simple flour and water, beaten well and dropped into highly heated iron moulds, which, when made properly, are a worthy rival in lightness and deliciousness of even the lightest of fine flour raised or soda buscuit? A. Because of an unreasonable prejudice in favor of Graham flour, which may be, and often is, exceedingly unwholesome.

(6) J. N. H. asks: 1. Can a locomotive push any more cars up a grade of 100 feet to a mile than it can pull up? A. We think not, though it may occur that, with some peculiar arrangement of engine, which would throw more weight on the drivers, when on an incline and pushing. 2. Will it require any more power to force an inch square stream of water in the bottom of a tank 100 feet deep and overflow at the top, than it will to force the same up a pipe to the same height? A. Theoretically, no. 3. Can a 10 inch bore by 12 inch stroke engine do as much work, and as economically, as a 10x20? If not, what is the reason? A. No, as the losses by waste spaces, radiation, etc., are greater in proportion in the small engine.

(7) O. M. W. asks: 1. Will a vertical boiler 6 inches diameter and 12 inches high, 1 flue through the center, be large enough to run an engine 1 inch bore and 2 inch stroke? A. No; make it 18 inches to 24 inches high. 2. How much steam per square inch must I carry in the boiler to make the engine work one thirty-second horse power, and how thick must the boiler plates be—either of brass or copper? A. About 45 pounds per square inch. You cannot make it much less than one-eighth inch thick, and make good work. This will be sufficient for strength. 3. Will it make any difference if the steam ports are round or square? State size, round or square. A. One-fourth of an inch or five-sixteenths of an inch diameter. 4. Will this engine run a small lathe (lathe 3 inches swing)? A. Yes. 5. Will a one-fourth inch safety valve be large enough for a vertical boiler, one flue through the center, outside diameter 6 x 12 inches? A. Make your safety valve not less than half inch diameter.

(8) W. E. G. writes: I am trying to master all the rules pertaining to engineering as laid down by Haswell. In hydraulics I find a rule to compute the volume of water discharged from a pipe, viz., $39{\cdot}27\sqrt{\frac{h\,d^5}{l}} = V$ in cubic feet per second. I would like to know where the factor 39·27 comes from and what it is? A. The multiplier 39·27 is the product of 50, the constant of velocity in feet per second x 0·7854, the area of a circle of unity, diameter 0.7854x50=39·2700. 2. What is the general meaning of wire drawn, as sometimes applied to steam? A. Wire drawn is an expression used to signify drawing steam, air, or other fluid, through an opening reduced in area from the general area of the pipe, as in partially closing the throttle valve of an engine.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. F. J.—It is very common mineral—iron pyrites—composed of iron and sulphur.—E. I. S.—The clay contains too much ferruginous silicious matter to be of much value.—E. P. M.—(U. S. C.) It is kaolin of very fair quality. If properly "washed" it could be used to advantage in the manufacture of white ware and enamels, etc.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending March 7, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Aeriform fluids, apparatus for mixing, J. F. Barker 254,589
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a block of ice, but it was too deeply embedded to get at it. | the most powerful is erroneous, as is the cognate idea that | butter, but the profit is very small.

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